THE NOMENCLATURE OF PETROLOGY

ARTHUR HOLMES

A. D. Lumb.
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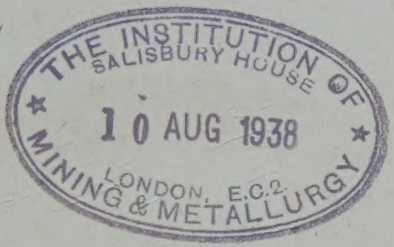

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THE NOMENCLATURE OF PETROLOGY

WITH REFERENCES TO SELECTED LITERATURE

BY

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The Nomenclature of Petrology

INTRODUCTION.

Some years ago I began the compilation of a card-catalogue of petrographic and associated terms, for the use of students in the Geological Department of the Imperial College of Science and Technology. Each card gave a brief description of the meaning (or meanings) of the term to which it was devoted, together with references to those papers on the subject which were available in the departmental library of the College, a library which, thanks to the collections made by the late Professor J. W. Judd and others, is unusually rich in author's separates. As the catalogue grew, its general usefulness became apparent; and a series of suggestions that it should be developed and published led me finally to the conclusion that such a course would not be unjustified.

There are many geological glossaries in which petrological terms find a place, but they are for the most part old, and to-day they are but little used, or

even known.[1] Several petrological books contain glossaries; notably Sir Jethro Teall's great work, *British Petrography* (1888), and J. R. Kemp's *Handbook of Rocks*. The latest edition of Kemp's book was published in 1918, and contains a wealth of information, particularly in relation to the older terms and the newer American terms. The only independent publication of the kind, however, appears to be the *Lexique Pétrographique* of Lœwinson-Lessing (Paris, 1901). This invaluable work is now nearly twenty years old, and so luxuriant has been the growth of nomenclature during the last two decades, that the *Lexique* no longer serves as an adequate guide through the somewhat tangled forest of names.

The complexity of petrological nomenclature at the present day is demonstrated by the following list, in which examples are given to illustrate the varying characters and principles on which names have been based from time to time.

Classical: basalt, basanite, obsidian, porphyry, syenite.
Popular: chert, cokeite, forellenstein, gabbro, gneiss, granite, greisen, hälleflinta, loess, marl, minette.
Structure: augen-gneiss, banket, cipolino, dermolith, folia-

[1] Among those examined for the purpose of this book are the following :—
G. Roberts : *An Etymological and Explanatory Dictionary of the Terms and Language of Geology*, 1839.
D. Page : *Handbook of Geological Terms*, 1859 & 1865.
W. Humble : *Dictionary of Geology and Mineralogy*, 3rd Ed., 1860.
G. H. Kinahan : *A Handy Book of Rock Names*, 1873.
B. von Cotta (Trans. by P. H. Lawrence) : *Rocks Classified and Described*, 1878.
T. H. Oldham : *Geological Glossary*, 1879.

tion, knotenschiefer, lithophysæ, oolite, perlite, pudding-stone, rhyolite, schist, variolite.

Texture: anamesite, aphanite, granulite, hornstone, lithoidite, pegmatite, rhomb-porphyry.

Roughness: grit, trachyte.

Colour: eclogite, graywacké, greenstone, leucocratic, leucophyre, melanocratic, melaphyre, muscovadite, troctolite.

Lustre: euphotide, lamprophyre, pitchstone.

Fusibility: eurite, pyromeride, tachylyte.

Organic characters: coral-sand, crinoidal limestone, diatomite, globigerina-ooze, lignite, miliolite.

Mineral characters: aplite, diorite;

albitite, amphibolite, anorthosite, argillite, augitite, hornblendite, quartzite, peridotite;

albite-enstatite rock, anorthite rock, muscovite-rutile rock, quartz-barytes rock;

glauconitic sandstone, glaucophane-schist, hornblende-granite, mica-schist, nepheline-syenite, olivine-basalt, quartz-monzonite, sillimanite-gneiss.

Chemical characters: alkali-rocks, anthracite, calc-alkali-rocks, calc-flinta, calciphyre, picrite, soda-rhyolite.

Use: laterite, novaculite.

Mode of formation: crush-breccia, flow-breccia, mylonite, stalactite.

Alteration: diabase, rapakivi.

Relative age: palæopicrite, proterobase, protogine.

Tribal names: gondite, ossypite.

Surnames: buchnerite, charnockite, dolomite, grahamite, ulrichite.

Place-names: cornubianite, ivernite, norite;

andesite, bostonite, canadite, jacupirangite, laurdalite, monchiquite, nevadite, sussexite, tonalite, wyomingite.

Hunne diabase, Markle basalt, Ponza trachyte.

Compound rock-names: granodiorite, rhyodacite, syenodiorite, trachydolerite.

Greek prefixes: apo-rhyolite, epidiorite, hyalobasalt, katagneiss, micropegmatite, orthogneiss, paragneiss, pseudotachylyte.

Greek suffixes: basanitoid, dacitoid, graneid, pegmatoid, syenoid.
Mnemonics: felsic, femic, mafic, salic.

For many years the fashion has been established of basing new rock-names on geographical names, a method that burdens the memory with many ugly and cacophonous terms, leads sometimes to redundancy, and fails to suggest the distinctive characters of the rock-types so described. It is difficult, however, to see how these objections can be altogether avoided. A different application of the method has sometimes been made, a new type being described partly in terms of a well-known rock-name, and partly in terms of the locality where the type-rock occurs. Thus we have Ponza trachyte, Hunne diabase, and Markle basalt. More purely descriptive names, formed by adding mineral-prefixes to existing rock-names, such as *biotite-hornblende-granite*, are self-explanatory; and the same advantage is shared by compound terms like *granodiorite*, *trachyandesite*, and *melanocratic olivine-trachydolerite*. There is much to be said in favour of combinations of these kinds, as they reduce the number of fundamental names to be remembered, and are of wider application than specific names. Many protests have been made against the use of long compound-names, but, unless they become ridiculously cumbrous, they are thoroughly justified in the interests of clearness, as they are, for example, in organic chemistry.

A geographical appellation already established, such as *lugarite* or *marloesite*, should not be

adopted for a rock from a fresh locality, unless the identity of type so implied is sufficiently close to avoid all chance of misconception. On the other hand, a new name should not be resorted to until every other possibility has been tested and found inadequate. There is undoubtedly an attraction in the creation of new names, and in too many cases that attraction has not been dispelled by the verbal discords eventually produced. On several occasions in my own experience I have been inclined to coin specific names. A riebeckite-ægirine granite from Angola[1] was a temptation for a time, but fortunately it was resisted. Otherwise our nomenclature would have been burdened with two new and unnecessary synonyms, for simultaneously Lacroix described a similar rock from Madagascar[2] under the name *fasibitikite*. In a case like this I consider that three words are better than one. Brevity of expression is by no means an unmixed blessing, and the one word may require a whole paragraph of explanation.

It would, of course, be desirable if definitions of rock-names could be framed by an International Committee endowed with authority to fix meanings finally, and to decide on the validity of new terms at suitable intervals. Unfortunately such a counsel of perfection is not likely to be sought for many years, and even were a powerful committee to be formed, its authority would sooner or later be sapped by disagreement. One such attempt to

[1] A. Holmes: *Geol. Mag.*, 1915, p. 267.
[2] *C.R.*, clxi, 1915, p. 253.

standardise nomenclature revealed so wide and stubborn a divergency of opinion as to its practicability, and the individual rights of authors to use terms as they choose, that no final decisions were arrived at, and only a few general suggestions and the revised *Lexique* of Lœwinson-Lessing emerged from the conferences.[1] The authors of the *Quantitative Classification of Igneous Rocks* have summed up the position by a quotation so happy that no apology is necessary for repeating it here.[2]

"There's glory for you," said Humpty Dumpty.

"I don't know what you mean by glory," Alice said.

Humpty Dumpty smiled contemptuously. "Of course you don't—till I tell you. I meant there's a nice knock-down argument for you!"

"But glory doesn't mean 'a nice knock-down argument,'" Alice objected.

"When *I* use a word," Humpty Dumpty said in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."

"The question is," said Alice, "whether you *can* make a word mean so many different things."

"The question is," said Humpty Dumpty, "which is to be master—that's all."

Alice Through the Looking Glass (Lewis Carroll).

Two main difficulties stand in the way of universal agreement. One of these is the natural tendency of words in active use to grow, and

[1] *Comptes Rendus*, viii, *Congrès Géologique International, Paris* (1900), 1901.

[2] W. Cross, J. P. Iddings, L. V. Pirsson, & H. S. Washington: *Journ. Geol.*, xx, 1912, p. 559.

gradually to assume a wider and therefore less precise meaning than that for which they were originally intended; while in time they may come to have a totally new, and at first sight quite unrelated, meaning. The standard petrological example of a word illustrating this process is *porphyry*; and quite recently the term *dedolomitisation* began to extend its scope, though in this case the tendency was thwarted by a timely protest.[1] Even in 1811 we find Pinkerton complaining in his *Petralogy* that the term *freestone*, instead of being restricted to "the noblest of the common limestones," had been inaccurately applied to sandstones! He overcame this "abuse of language" by proposing *konite* for the limestones so beloved of the mediæval freemasons. And introducing another rock which he describes with great enthusiasm, he writes, "This is the celebrated pudding-stone of England, so much in request in foreign countries; but this name commonly exciting a smile among the illiterate, and the application being since enlarged to a great number of glutenites,[2] of a different nature and origin, forming entire chains of mountains (while this is confined to a very small district in England, and is found nowhere else in the world), it has been thought proper to distinguish it by the name of Kollanite; derived from the Greek, denoting its appearance of being cemented together."

[1] *Geol. Mag.*, 1919, p. 458.
[2] A term, now obsolete, for breccias, conglomerates, and sandstones.

The late A. D. Darbishire in his posthumous and unfinished *Introduction to a Biology* (1917) discussed the wanderings of words in relation to a subject where the danger is even greater than in ours.

"If there is a possibility that words give a semblance of progress in interpretation, where in reality there is none, it is desirable that some attention should be paid to the relation between word and thought. . . .

"A word and its meaning, especially in the case of ideas, are united together by a slender, elastic bond which is now contracted, now stretched to its uttermost. . . . So we see the word and its meaning dancing to each other in an airy medium, like a pair of gnats in the lee of a gorse-bush. This, alas! is the simplest case. The more complicated and much more common cases are those in which one word has more than one meaning, or where one meaning has more than one word to express it; these are the cases which, in verbal life, are productive of trouble" (pp. 19-21).

Such difficulties are sometimes accentuated by human perversity: witness Rosenbusch's treatment of Vogelsang's term *granophyre*, and Brögger's appropriation of *foyaite* and *ditroite*. Consider also the introduction of the terms *aa* and *aphrolith* to denote the qualities already simply expressed by *block-lava*; and of *midalkalite* and *syenoid* to take the place of *nepheline-syenite*.

The second difficulty standing in the way of agreement is intimately related to the first.

Although petrology is now developing rapidly, no generally accepted classifications of the major groups of rocks have yet been devised with sufficient detail to guide the choice of terminology and to restrain its tendency to spread outwards and become confused. Existing classifications involve a multitude of dimensions—mode of origin, mineral and chemical composition, proportions of minerals, structure, texture, mode of occurrence, degree of alteration, etc.—and any given name is therefore liable to wander in various directions according as insistence is placed on one or other of its possible connotations. A successful classification will need to be sufficiently elastic to avoid the despotism of merely arbitrary and unsignificant division, and yet sufficiently rigid to standardise the meanings of its collateral terminology.

At the present time the field of petrology still contains many uncultivated corners, and until the whole has become familiar ground, existing systems of classification and nomenclature must be regarded as on probation. It is my impression that stability will be approached, not primarily as a result of any committee, international or sectional, but by the co-ordinating work of a single petrologist of genius whose authority, the outcome of his own success and influence, will be far superior to the merely temporising and democratic authority of a committee.

Meanwhile it seems desirable to take stock, and to place on record the existing nomenclature in accordance with its current usage. It is hoped that

this book will meet the need by creating a standard of reference which may to some extent limit future vacillations, and prevent unnecessary clashing between new terms. The main object of the book is, however, to be practically useful by serving as a guide to student, teacher, research-worker, and professional geologist, and indeed to all who need to follow petrological literature or to contribute to its pages.

The work involved in revising and amplifying the original card-catalogue, undertaken about a year ago, proved to be more arduous than was at first anticipated. It has, however, never descended to drudgery or mere compilation. On the contrary it has been in the nature of a literary exploration, leading one to examine a century's evolution of petrological thought and method, and to share the delights of many a curious traveller through little-known corners of lands the world over. Unsatisfactory though certain parts of the nomenclature may be as an instrument of thought and exposition, it is, as a whole, unusually rich in pleasant associations, geographical, historical, and even psychological. Perhaps this romantic aspect of a subject bristling with technicalities is a dangerous one, for it tends to support the natural conservatism of even scientific men, and so, perhaps, to retard the development of that ideal system of nomenclature which we all hope for but cannot as yet create.

Certain attempts to systematise nomenclature have already been made, particularly in the field of

igneous rocks. It is desirable to draw attention to some of these, because, with a few exceptions, the terms they comprise have been excluded from the glossary that follows.

Jevons suggested a wholesale use of prefixes consisting of contracted, or rather mutilated, forms of structural, textural, and mineral names, together with a few chemical and qualifying syllables.[1] He thus arrived at such combinations as *ophit-olidolerite*, *diopsi-mipegmo-rhyolite*, *rhomfels-pyralisyenite* (=Laurvikite), and *eudœgi-midalkalite* (=Lujaurite). Such proposals are obviously foredoomed to failure. In the words of Professor Bonney, "Time is not so valuable, or paper and printing so expensive, that we should talk or write 'gibberish' to save a few letters."

A more reasonable method has recently been proposed by Professor Shand,[2] based in its application on the classification of igneous rocks according to his principle of saturation.[3] He suggests—

(1) That the names of oversaturated and saturated rocks should end in the customary suffix *-ite*; *e.g.*, *granite*, *syenite*, etc.;

(2) That the names of unsaturated rocks should carry—

(*a*) the prefix *sub-*, or the suffix *-ole*, to indicate that the dyad or triad metals are unsaturated; *e.g.*, *subgabbro*, for *olivine-gabbro;*

(*b*) the suffix *-oid*, to indicate that the monad

[1] H. S. Jevons: *Geol. Mag.*, 1901, p. 304.
[2] S. J. Shand: *Geol. Mag.*, 1917, p. 466.
[3] *Geol. Mag.*, 1913, p. 508; 1914, p. 485; 1917, p. 115.

metals are unsaturated; *e.g.*, *syenoid*, for *nepheline-syenite;* and

(*c*) a combination of the prefix *sub-* and the suffix *-oid*, to indicate that both monad and dyad metals are unsaturated, *e.g.*, *subtheraloid* or *subgabbroid*, for *olivine-theralite*.

The principle adopted is excellent, but the choice of suffix, *-oid*, is unfortunate and cannot be accepted, for it has already been seriously overworked in other directions. It has been used in adjectival terms like *granitoid* and *trachytoid*, to express texture or composition; and in substantive form in the term *pegmatoid*, to denote very coarse-grained facies of igneous rocks differing from pegmatite proper by the absence of graphic-texture; and in terms of which *dacitoid* is a typical example, to connote similarity (to dacite) of chemical composition combined with dissimilarity of mineral composition.

The authors of the Quantitative Classification have introduced a very comprehensive nomenclature, the greater part of which is built up with the aid of a variety of suffixes and mnemonic contractions. Terms like *felsic* and *mafic* are extremely useful, and even though they have been regarded as technical slang, they have justified their invention by having been widely adopted. On the other hand, more ambitious and less useful terms such as *alferfemphyric* are ugly and have not met with a similar measure of favour. Cross, Iddings, Pirsson and Washington[1] have themselves made

[1] These authors are referred to in the glossary by *C.I.P.W.*

the recognition of much of their nomenclature a necessity, for they have forcibly and persistently made use of it in a long series of publications which other petrologists cannot afford to ignore. Most of the new terminology, however, is intimately related to, and only used in connection with, the Classification itself, and with the latter it must therefore stand or fall. Unfortunately, the principles on which the Classification is based leave the main problems of petrology untouched, fail to open out new fields of research, and therefore do not constitute a creative contribution to the subject they were intended to illuminate. From this point of view the apparently wide influence exerted by the Classification in recent years has been largely factitious. Nevertheless, it is only fair to add that the authors of the Classification have rendered very real services to petrology by promoting greater accuracy of description and analysis, and by introducing the conception of the *norm*, which provides an admirable method of recalculating, comparing, and interpreting rock-analyses.

Another systematic terminology to which reference must be made has been proposed and extensively used by Grabau in his *Principles of Stratigraphy* (1913). The terms are summarised on pp. 296-7 of that work, and constitute an attempt, laudable in principle, to provide a comprehensive nomenclature for sedimentary and associated rocks. By means of a number of prefixes representing chemical or mineral composition and agency of formation, compound terms are built up at will by

combining them with a series of grade designations: *rudyte*, corresponding to gravel, shingle, pebbles, etc.; *arenyte*, corresponding to sand; and *lutyte*, corresponding to mud or rock-flour. Thus *anemoarenyte* in ordinary terms would be described as æolian sand; *hydrosilicirudyte* as quartz-conglomerate; and *pyrolutyte* as volcanic ash or dust. The extent of departure from current nomenclature is unnecessarily wide, and it seems doubtful whether such innovations will ever be recognised by adoption. Grabau's use of the terms *exogenetic* and *endogenetic* is particularly unfortunate and tends to confusion of thought.[1] He describes rocks as "exogenetic" when they have been formed by agents acting from without, that is, acting externally with respect to, and independently of, the finished rock, as in the case of loose detrital sediments. Other rocks, formed by agents acting from within, he describes as "endogenetic," this category including igneous rocks, saline deposits, and organic accumulations. The two contrasting terms, although they are applied to rocks, are thus made to be synonymous with *allogenic* and *authigenic* respectively, and as the latter terms lead to a far clearer realisation of the primary division proposed by Grabau there seems to be no reason for rejecting them. The sentence "A calcareous sandstone contains allogenic grains held together by an authigenic cement," gives an accurate statement of fact, whereas the classifica-

[1] *Amer. Geol.*, xxxiii, 1904, p. 228.

tion of a calcareous sandstone as "exogenetic" in Grabau's sense expresses only part of the truth.

The obvious and most serviceable meanings of *exogenetic* and *endogenetic* are those proposed by Mr. T. Crook,[1] and they should be adopted and used as defined by him. *Exogenetic* applies to processes originating and operating at or near the earth's surface, and to the rocks and ore-deposits formed by such processes. *Endogenetic* applies to processes originating internally and operating deep-seatedly in the earth's crust, or from within outwards, and to the rocks and ore-deposits formed by such processes.

If it be objected that Grabau has priority as regards date of publication, the reasons for rejecting his usage would be based on the following points—

(*a*) The French equivalents of the terms, *exogène* and *endogène*, have long been used to express the division of rocks into "eruptive" and "sedimentary" groups.

(*b*) Reference to Murray's Oxford Dictionary will show that *exogenetic* had previously been recognised in the sense followed by Crook.

(*c*) Grabau has used the terms for a conception which they fail adequately to express, and for which wholly adequate terms were already available.

Only one of Grabau's terms, *rudaceous*, has been included in the glossary, because with *arenaceous*

1 "The genetic classification of rocks and ore deposits," *Min. Mag.*, xvii, 1914, p. 72.

and *argillaceous*, it completes a Latin trilogy for the three main groups of detrital sediments. As far as I know there has not hitherto been a term of Latin form for coarsely graded detritus of the kind which is described in the corresponding Greek trilogy as *Psephitic*.

Several of the Cross-Iddings-Pirsson-Washington terms have been incorporated, including a selection of the chief key-words and prefixes of the nomenclature associated with the divisions of the classification. The greater part of that terminology has been excluded, and those wishing to become familiar with its details are referred to the various publications cited below.[1]

In addition to the excluded terms already referred to, certain others have also been omitted :—

(*a*) Modifications of existing terms such as Johannsen's[2] field terms, *graneid*, *dolereid*, *anameseid porphyry*, etc.; and Dana's[3] and Graubau's[4] terms ending in *-yte* instead of *-ite*.

(*b*) Most compound terms built up from mineral qualifiers. These are, of course, in-

[1] C.I.P.W. : *Journ. Geol.*, x, 1902, pp. 555-690.
— *Quantitative Classification of Igneous Rocks*, Chicago, 1903. (Glossary on pp. 261-284.)
J. P. Iddings : *Igneous Rocks*, I, 1909, pp. 394-454.
C.I.P.W. : *Journ. Geol.*, xx, 1912, pp. 550-561.
G. I. Finlay : *Introduction to the Study of Igneous Rocks*, 1913, pp. 143-221.
H. S. Washington : *Chemical Analyses of Igneous Rocks* (U.S.G.S. Prof. Pap., 99), 1917, pp. 1151-1161.
[2] A. Johannsen : *Journ. Geol.*, xix, 1911, p. 317.
[3] J. D. Dana : *Am. Journ. Sci. and Art*, xvi, 1879, p. 336.
[4] A. W. Grabau : *Principles of Stratigraphy*, 1913, p. 298.

numerable and would unnecessarily overburden the glossary.[1] Where the qualifier has become an essential part of the name of an important group of rocks, as in *quartz-diorite*, *nepheline-syenite*, *chlorite-schist*, etc., the resulting term has, however, been included.

(*c*) Most obsolete terms, such as those proposed by Pinkerton in his *Petralogy*. Two of these, *konite* and *kollanite*, have already been mentioned. A few terms that have more recently fallen into desuetude are introduced, partly to indicate the reason for their obsolescence and partly because they may be met with in literature that has not yet been superseded.

With these exceptions the glossary forming the greater part of this book is believed to be reasonably complete. The general treatment is historical rather than critical, the main object being to record the customary current meaning of each term, together with the original author and the date of its first use, and in the case of rock-names the type-locality. It has been no part of my purpose either to recommend or discourage the use of any recognised term, and throughout I have abstained from discussing either the value of a term, or the need for it. A critical examination of terminology could be conducted more satisfactorily from the standpoint of classification.

[1] See also J. D. Dana: *Am. Journ. Sci.*, xxxii, 1886, p. 71.

As will be seen from the glossary itself, the terms incorporated include not only those describing rocks, structural and textural features, modes of occurrence, and processes, but also a selection of terms associated with petrographic methods, most terms referring to crystal optics and physics being excluded. In the case of terms denoting the mode of occurrence of igneous rocks (*e.g. batholith*) it seemed desirable to introduce a uniform ending *-lith* throughout. Thus, instead of Gilbert's *laccolite* and Harker's *phacolite*, the forms *laccolith* and *phacolith* have been adopted. This course serves to distinguish such names from mineral and rock names, and in the case of *phacolith* it avoids possible confusion with the zeolite *phacolite*. Dr. Harker, who has hitherto used the ending *-ite*, raises no active objection to the change suggested.

In the case of the mineral names *ægirine*, *nepheline*, *nosean*, *hauyne*, the form of spelling here given has been retained, but *analcime* has been allowed to yield to *analcite*. The original and more harmonious termination was given by Haüy in 1801, but the more systematic ending adopted by Galitzin, also in 1801, seems to have achieved greater currency. Moreover, the latter form has been fixed by the rock-name *analcitite*, whereas it is *nepheline* and not *nephelite* that is fixed by the corresponding rock-name *nephelinite*.

Selected references to the literature of the respective subjects have been appended to many of the items of the glossary. The choice of reference has not always been easy. It is manifestly impossible

to give a complete series of references in the case of the older terms, and to give the original references alone is neither desirable nor necessary, as they are already available in Lœwinson-Lessing's *Lexique*. The guiding principle has been to draw attention to recent and readily accessible papers which in turn serve to open out the older literature. Had it been followed rigidly this course would have led to the exclusion of many of the important papers which we owe to the pioneers and veterans of petrological research, and it would then have appeared that the authors alluded to had been unduly neglected. For this reason occasional references to the older papers have been inserted in appropriate places.

For the literature dealing with the igneous geology of particular districts the second part of Iddings' *Igneous Rocks*, Vol. II., is the most accessible source; while for individual rock-types the copious references given in Washington's tables of chemical analyses[1] cover the whole field up to 1913.

Appendices giving French and German words have been added as a help to students reading petrological literature in these languages.[2] Terms of an international character, and words which are readily recognised by their similarity to the Eng-

[1] *U.S.G.S., Prof. Pap.* 99, 1917.

[2] A useful dictionary for scientific purposes is *A German-English Dictionary for Chemists*, by A. M. Patterson, 1917, as it contains an ample general vocabulary in addition to the technical terms of chemistry and related subjects.

lish equivalents have been omitted. The German appendix has been compiled by Miss J. H. Robertson, for whose help I wish here to acknowledge my gratitude. Appendices setting forth Greek and Latin words have also been added in order to make clear the significance of the many petrographical and mineralogical terms into which they enter.

Classification Tables have been introduced in order to bring together terms representing closely related concepts. These will be found useful not only in taking a broad survey of certain parts of the subject, but also in serving as a guide to new or forgotten terms. The tables also bring out the "patchiness" of petrological nomenclature. Certain parts of the subject are heavily burdened with redundant terms, and with others that depend for their justification on differences so slight or trivial that they have but little practical value. Other parts of the subject, particularly those involving altered and metamorphic rocks have still a somewhat restricted nomenclature. This is probably due to the fact that until recent years attention had been focussed almost exclusively on igneous rocks, with the result that petrology has developed somewhat unequally. Fortunately the outlook is gradually widening, and even ore-deposits and meteorites are beginning to take a recognised place in the subject to which they properly belong.

In the hope of making the glossary as representative as possible of customary modern usage, twenty preliminary proofs were pulled and sent to various

petrologists with a view to eliciting suggestions, comments, and constructive criticism. This plan proved highly successful, and a very valuable series of replies was received from the following gentlemen: Prof. T. G. Bonney, Prof. P. G. H. Boswell, Mr. Alfred Brammall, Prof. Grenville A. J. Cole, Prof. A. Hubert Cox, Mr. T. Crook, Dr. J. V. Elsden, Dr. J. W. Evans, Mr. J. F. N. Green, Dr. A. Harker, Dr. W. R. Jones, Prof. A. Lacroix, Dr. G. T. Prior, Prof. P. Quensel, Mr. W. Campbell Smith, Sir Jethro Teall, Dr. H. H. Thomas, Mr. G. W. Tyrrell and Prof. W. W. Watts. To all these I owe my heartiest thanks for their very substantial help in bringing to completion my self-appointed task. As a result of their approval of the project itself, and their active assistance in suggesting additions and modifications, I am supported in my belief that the book will meet a real need, and encouraged in my hope that the design originally conceived may have been brought to a successful issue.

Finally, I wish to invite the further aid of those who use the glossary, by asking them to acquaint me with the particulars of any errors of interpretation or reference that may be detected, and to suggest any additional terms that have unwittingly been overlooked. Should the opportunity arise, such corrections will be incorporated in a revised edition, and as the "completion" of a glossary such as this is necessarily relative to the date of publication, authors of new terms are invited to

ensure their future inclusion by communicating with me either directly, or, if necessary, through the publishers.

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January, 1920.

GLOSSARY

A

Aa, *Dutton*, 1883. — A Hawaian term for block-lava, consisting generally of a rough tumultuous assemblage of clinker-like scoriaceous masses. = *Aphrolithic lava.* Cf. *Pahoehoe.*

R. A. Daly : *Igneous Rocks and their Origin*, 1914, p. 291.
J. A. Jaggar : *Journ. Wash. Acad. Sci.*, vii, 1917.

Aasby Diabase, *Törnebohm*, 1877.—A type of olivine-dolerite containing biotite, ilmenite, and apatite, in addition to labradorite, augite and olivine. (Aasby, Sweden.)

Absarokite, *Iddings*, 1895.—A porphyritic, basaltic or trachy-doleritic rock, characterised by the presence of phenocrysts of olivine, augite, and labradorite in a base containing orthoclase-mantled labradorite. (Absaroka Range, Yellowstone Park.)

J. P. Iddings: *Journ. Geol.*, iii, 1895, p. 938.
— *U.S.G.S., Mon.*, xxxii (ii), 1899, p. 328.

Abyssal Assimilation, *Daly*.—See **Assimilation.**

Abyssal Injection, *Daly*, 1906.—The process whereby magmas originating at considerable depths are considered to have been driven up through deep-seated contraction-fissures in the earth's crust.

R. A. Daly : *Igneous Rocks and their Origin*, 1914, p. 174.

Abyssal Rocks, *Brögger*.—A general term for rocks of major intrusions. Cf. *Plutonic.*

Accessory.—A term applied to minerals occurring in small quantities in a rock, and whose presence or absence does not affect its diagnosis.

R. H. Rastall & W. H. Wilcockson : *Q.J.G.S.*, lxxi, 1915, p. 592.
P. G. H. Boswell: *Geol. Mag.*, 1916, p. 165.

Accidental Inclusions, *Harker,* 1900.—A term applied to xenocrysts or xenoliths having no genetic connection with the igneous rocks in which they occur; = *enclaves enallogènes.*

A. Harker: *Journ. Geol.*, viii, 1900, p. 389.

Achondrite, *Cohen.*—A general term for stony meteorites (aerolites) free from the spheroidal structures known as *chondrules.* Cf. *Chondrite.*

Acid.—A term applied to igneous rocks having a higher percentage of silica than orthoclase, the limiting figure commonly adopted being 66 per cent. Cf. *Persilicic* and *Oversaturated.*

Adamellite, *Cathrein,* 1890.—A term applied originally to an orthoclase-bearing tonalite, and now used generally for granites in which plagioclase varies from one-third to two-thirds of the total felspar. = *Quartz-monzonite.*

(Mt. Adamello, Tyrol.)

W. C. Brögger: *Eruptivgest. Kristiania,* ii, 1895, p. 61.

Adinole, *Haussmann,* 1847.—A contact modification of shale or slate metamorphosed and albitised by doleritic (albite-diabase) intrusions; consists of a mosaic of albite, or albite and quartz, with interstitial chlorite and iron-ores.

H. Dewey: *Trans. Roy. Geol. Soc. Cornwall,* xv, 1915, p. 71.

Adobe, *Russell,* 1889.—A loess-like deposit occurring in the plains and basins of the Western States, and in the arid parts of Spanish America.

Adsorption. — A term applied to the change in concentration of solutions and colloids where they come into contact with surfaces.

Aeolian.—A term applied to deposits whose constituents have been carried by, and laid down from, the wind.

S. C. Stuntz & E. E. Free: *U.S.A. Dept. Agriculture, Bureau of Soils, Bull.* 68.

Aerolite.—A general term for meteoric stones, that is for meteorites composed mainly of silicates such as pyroxenes and olivine, with or without small quantities of nickel-iron, troilite, etc. According as

chondrules are present or absent, aerolites are divided into *chondrites* and *achondrites* (*q.v.*).

Agglomerate, *Lyell*, 1831.—A chaotic assemblage of coarse angular pyroclastic materials.

Aggregate Polarisation.—The mottled appearance seen between crossed nicols of a mineral aggregate composed of minute particles which are orientated haphazardly.

Agpaite, *Ussing*, 1911.—A general term applied to the felspathoidal rocks of Ilimansak, Greenland, and including sodalite-foyaite, naujaite, lujaurite, and kakortokite.

N. V. Ussing: *Medd. om. Grönland*, xxxviii, 1911.

Ailsyte, *Heddle*, 1897.—A variety of riebeckite microgranite, or paisanite. (Ailsa Craig.)

J. J. H. Teall: *Min. Mag.*, ix, 1891, p. 219.

Akerite, *Brögger*, 1890. — A variety of quartziferous augite-syenite, containing soda-microcline and oligoclase. (Aker, Norway.)

W. C. Brögger: *Eruptivgest. Kristiania*, ii, 1895, p. 43.

Alaskite, *Spurr*, 1900.—A leucocratic granite, containing quartz and alkali-felspars, with only traces of other minerals. (Alaska.)

J. E. Spurr: *Amer. Geol.*, xxv, 1900, p. 231.

Albertite, *How*, 1860.—A black variety of bitumen with a brilliant lustre and conchoidal fracture. H = 1–2; S.G. about 1.1. It differs from manjak and uintaite by being practically insoluble in alcohol, and only partly so in turpentine. (Albert Mines, New Brunswick.)

Albite-diabase. — An altered and albitised doleritic rock, containing albite in place of the usual plagioclase; purple brown augite more or less replaced by epidote, chlorite, and calcite, and titaniferous magnetite; the intrusive equivalent of *spilite*.

H. Dewey & J. S. Flett: *Geol. Mag.*, 1911, p. 202.

Albite-enstatite Rock, *Elsden*, 1905.—A local facies, possibly aplitic, of the enstatite-diorite of Penclegyr. (Porth Gain, Pembroke.)

J. V. Elsden: *Q.J.G.S.*, lxi, 1905, p. 579.

Albitisation.—The process, due to paulopost juvenile action, whereby the plagioclase (originally richer in anorthite) of igneous rocks is replaced by albite; *e.g.*, in *spilite*.

E. B. Bailey & G. W. Grabham: *Geol. Mag.*, 1909, p. 250
H. Dewey & J. S. Flett: *Geol. Mag.*, 1911, p. 202.
N. Sundius: *Geol. För. i Stockholm Förh.*, xxxiv, 1912, p. 317.

Albitite, *Turner*, 1896.—A leucocratic soda-syenite or porphyry composed almost wholly of albite.

H. W. Turner: *U.S.G.S. 14th Ann. Rep.*, ii, 1896, p. 477.

Albitophyre, *Coquand*, 1857.—A porphyry in which the felspar phenocrysts and the microlites of the groundmass are chiefly albite. Cf. *Orthophyre*.

A. Holmes: *Geol. Mag.*, 1917, p. 403.

Alboranite, *Becke*, 1899.—A variety of "hypersthene-andesite," containing plagioclase at least as calcic as labradorite; *i.e.*, hypersthene-basalt with a microlitic texture like that of an andesite.

(Alboran Is., Spain.)

Aleutite, *Spurr*, 1900.—A term suggested for porphyritic varieties of belugite (rocks intermediate between diorite and gabbro) having an aphanitic or finely crystalline groundmass. (Aleutian Is.)

J. E. Spurr: *U.S.G.S., 20th Ann. Rep.*, Pt. vii, 1900, p. 195.

Algovite, *Winkler*, 1859.—A group-term for a series of augite-plagioclase rocks ranging from dolerite through porphyritic varieties to gabbro.

(Algäuer Alps.)

Alkali Rocks. — Igneous rocks in which the abundance of alkalies in relation to other constituents has impressed a distinctive mineralogical character; generally indicated by the presence of soda pyroxenes, soda amphiboles, and/or felspathoids. Cf. *Calc-alkali Rocks*.

A. Lacroix: *Nouv. Arch. Mus. d'Hist. Nat.*, iv, 1902, p. 178.
G. T. Prior: *Min. Mag.*, xiii, 1903, p. 254.
A. Harker: *Nat. Hist. Ig. Rocks*, 1909, p. 90.
N. L. Bowen: *Journ. Geol.*, Supp. to xxiii, 1915, p. 55.
A. Holmes: *Q.J.G.S.*, lxxii, 1916, pp. 268, 272.
R. A. Daly: *Journ. Geol.*, xxvi, 1918, p. 97.

Allalinite, *Rosenbusch,* 1895.—A term applied to completely altered gabbros, the secondary minerals of which—smaragdite, actinolite, and saussuritic aggregates — still occur as idiomorphic pseudomorphs after the original minerals, the initial texture of the rock being thus retained. Contrasted with *flaser-gabbro*, in which metamorphism has involved structural as well as mineralogical changes. (Allalin, near Zermatt.)

Allivalite, *Harker,* 1908. — A phanerocrystalline rock, consisting of anorthite and olivine in approximately equal proportions, or with felspar preponderating. (Allival, Rum.)

A. Harker: *Mem. Geol. Surv. Scot.*, 60 (Small Isles), 1908, p. 71.

Allochetite, *Ippen,* 1903. — A microlitic dyke rock with phenocrysts of labradorite, orthoclase, nepheline and augite in a groundmass of felsic minerals with augite and hornblende. (Allochet, Monzoni.)

J. A. Ippen: *Verhandl. d. K.K. Geol. Reichs., Wien,* 1903, p. 132.

Allochthonous, *Gümbel,* 1888. — A term applied to rocks of which the dominant constituents have not been formed *in situ.* Cf. *Autochthonous.*

Allothigenous, or **Allogenic,** *Kalkovsky,* 1880.—Terms, meaning *generated elsewhere,* applied to those constituents that came into existence outside of, and previously to, the rock of which they now constitute a part; *e.g.*, the pebbles of a conglomerate. Cf. *Authigenous.*

Allotriomorphic, *Rosenbusch,* 1887.—A term applied to those minerals of igneous rocks which are not bounded by their characteristic crystal faces. = *Anhedral = Xenomorphic.*

Allotropy.—A term denoting the capacity of an element to exist in more than one form while in the same state; *e.g.*, graphite and diamond, orthorhombic and monoclinic sulphur, oxygen and ozone.

A similar phenomenon is exhibited by many compounds, and is then generally known as *dimorphism* or *polymorphism,* though the term *allotropy* has also been extended to cover such cases, *e.g.*, the α, β, and γ forms of zircon, readily distinguished by their specific gravities.

For a discussion of allotropy in relation to rock magmas see W. H. Goodchild, *Mining Mag.*, xviii, 1918, p. 243.

Alluvium.—A general term for all detrital deposits resulting from the operations of modern rivers, thus including the sediments laid down in river-beds, flood-plains, lakes, fans at the foot of mountain slopes, and estuaries.

Alphitite, *Salomon,* 1915.—A term suggested for clays consisting largely of rock-flour, such as those washed and laid down from glacial débris.

W. Salomon: *Geol. Rund.*, vi, 1915, p. 398.

Alnöite, *Rosenbusch,* 1887.—A dyke-rock, containing phenocrysts of biotite, olivine and augite in a groundmass composed of melilite and augite, with sometimes perovskite, and other accessories. By increase of melilite alnöite passes into *melilite-basalt.* (Alnö, Sweden.)

F. D. Adams: *Am. Journ. Sci.*, xliii, 1892, p. 269.
J. S. Flett: *Trans. Roy. Soc. Edin.*, xxxix, 1900, p. 891.

Alsbachite, *Chelius,* 1892. — A porphyritic variety of aplite, sometimes containing garnet. (Alsbach, Odenwald.)

Alum-shale. — A shale impregnated with alum, the latter constituent being due to the action on sericite of sulphuric acid produced by the oxidation and hydration of pyrite.

Ambonite, *Verbeck,* 1905. — A variety of hornblende-biotite-andesite characterised by the presence of cordierite. (Ambon Is., Moluccas.)

Amherstite, *Watson & Taber,* 1913. — A variety of syenodiorite containing andesine-antiperthite. (Amherst Co., Virginia.)

T. L. Watson & S. Taber: *Geol. Surv. Virginia, Bull.* 3 A, 1913.

Amorphous.—A term applied to substances which are not known to possess the discontinuous vectorial properties or the periodic arrangement of component atoms that characterise the crystalline state.

A. F. Rogers: *Journ. Geol.*, xxv, 1917, p. 515.

Ampelite. — A general term for black bituminous or carbonaceous shales, often pyritic.

Amphibole-magnetite Rock. — A granulose often banded rock containing grunerite and other ferruginous silicates, and magnetite, produced by the contact metamorphism of ferruginous cherts (taconite, jaspillite, etc.).

C. R. Van Hise & C. K. Leith: *U.S.G.S., Mon.*, lii, 1911, pp. 550, 558.

Amphibolite, *Brongniart*, 1827.—A granulose or glomero-blastic metamorphic rock, consisting essentially of amphibole and plagioclase, and often containing quartz, epidote, or garnet.

G. A. J. Cole: *Trans. Roy. Irish Acad.*, xxxi, 1900, p. 460.

J. J. H. Teall: *Mem. Geol. Surv.* (N.W. Highlands), 1907, p. 56.

F. D. Adams: *Journ. Geol.*, xvii, 1909, p. 1.

P. Eskola: *Bull. Comm. Géol. Finlande*, No. 40, p. 97.

A. Holmes: *Q.J.G.S.*, lxxiv, 1918, p. 58.

F. L. Stillwell: *Aust. Ant. Exped. Sci. Rep. A*, iii, I (1), (Met. Rocks, Adelie Land), 1918, p. 24, etc.

Amphibololite, *Lacroix*, 1894.—A general designation for phanerocrystalline igneous rocks entirely or almost entirely composed of amphiboles.

A. Lacroix: *Nouv. Arch. du Mus. d'Hist. Nat.*, vi, 1894, p. 270.

Amphoterite, *Tschermak*, 1883. — An achondritic meteorite composed essentially of bronzite and olivine, with small amounts of oligoclase and iron rich in nickel.

Amygdales or **Amygdules.** — Vesicles or vapour cavities of volcanic and occasionally of intrusive rocks, which have become filled with secretionary products (usually of late-magmatic origin), such as zeolites, chlorite, forms of silica and calcite. The

form *amygdule* is a diminutive of *amygdale*, and consequently the former is not strictly synonymous with the latter.

W. F. P. McLintock: *Trans. Roy. Soc. Edin.*, li, Pt. 1, 1915, p. 13.

A. Holmes: *Q.J.G.S.*, lxxii, 1916, p. 251.

Amygdaloid.—A general group-name for those volcanic rocks (andesites, basalts, etc.) which are characterised by the presence of conspicuous amygdales.

Amygdaloidal. — A term applied to rocks containing amygdales, and to the structure resulting from their presence.

Anabohitsite, *Lacroix*, 1914. — A variety of olivine-pyroxenite, containing hypersthene and hornblende, with a high proportion of magnetite and/or ilmenite. (Anabohitsy, Madagascar.)

A. Lacroix: *C.R.*, clix, 1914, p. 419.

Analcite-basalt, *Lindgren*, 1890.—An olivine-bearing basaltic rock, in which the predominant felsic mineral is analcite; felspar, if present, being merely accessory. Cf. *leucite-basalt* and *nepheline-basalt*.

H. S. Washington: *Journ. Geol.*, xvii, 1914, p. 742.

Analcite-dolerite. — A dolerite, containing analcite, usually as an interstitial constituent. The term is often used synonymously with *Teschenite*, but it is preferable to employ the latter term only for varieties containing soda-pyroxenes and/or soda-amphiboles. Cf. *Crinanite*.

Analcitisation, *Flett*, 1900. — The replacement of felspars or felspathoids by analcite by late or post-magmatic processes.

A. Scott: *Trans. Geol. Soc. Glasgow*, xvi, 1915-6, p. 34.

Analcitite, *Pirsson*, 1896.—A term applied to rocks which differ from analcite-basalt only by the absence of olivine. Cf. *leucitite* and *nephelinite*.

Anamesite, *Leonhard*, 1832.—A term meaning *intermediate*, applied to basaltic rocks that are of coarser grain than aphanitic basalts, and of finer

grain than those dolerites in which the individual minerals can be megascopically distinguished.

Anamorphism, *Van Hise,* 1904. — The constructive metamorphism of rocks, characterised by the formation of complex minerals at the expense of simpler ones.

C. R. Van Hise : *U.S.G.S. Mon.* 47, 1904.
C. K. Leith & W. T. Mead : *Metamorphic Geology,* 1915.

Anatexis, *Sederholm,* 1907. — An ultrametamorphic process in which deep-seated rocks are remelted by the emanation of heat and hot gases from below, thus providing regenerated magmas *in situ.* Cf. *Syntexis.*

J. J. Sederholm : *Bull. Comm. Géol. Finlande,* 23, 1907, p. 102.
—— *Cong. Geol. Inter. C.R.* xii (1913), 1914, p. 319.
P. J. Holmquist : *Bull. Geol. Inst. Upsala,* 15, 1916, p. 141.

Anchi-eutectic, *Vogt,* 1905.—A term applied to those rocks which are composed almost wholly of two or more minerals in nearly eutectic proportions.

J. H. L. Vogt : References as below.

Anchi-monomineralic, *Vogt,* 1905.—A term applied to those rocks which are composed almost wholly of one kind of mineral; *e.g.*, anorthosite, bronzitite, congressite, dunite, etc.

J. H. L. Vogt : *Norsk Geol. Tidsskrift,* i, No. 2, 1905; *Vidensk. Selsk. Skrift. Math- nat Klasse,* No. 10, 1908.

Anchorite, *Lapworth,* 1898. — A nodular and veined variety of diorite, the normal facies of the rock being variegated with dark mafic segregation patches and light felsic contemporaneous veins.

(Anchor Inn, near Caldecote, Nuneaton.)

C. Lapworth : *Proc. Geol. Assoc.,* xv, 1898, p. 419.

Anden-diorite, *Stelzner,* 1885.—A variety of quartziferous diorite having augite as its principal mafic mineral. (Argentine Andes.)

Andesinite, *Turner,* 1900. — A phanerocrystalline rock composed almost entirely of andesine.

Andesite, *Von Buch,* 1826.—A volcanic rock, generally porphyritic, composed essentially of plagioclase

(andesine or oligoclase, or having an average composition corresponding to those types), together with one or more of the mafic minerals, biotite, hornblende, and pyroxenes. The modern primary distinction between andesite and basalt does not depend on the absence or presence of olivine, or on the relative proportions of felsic to mafic minerals (though each of these criteria have been applied in the past), but on the composition of the plagioclase. (Andes.)

J. J. H. Teall: *Geol. Mag.*, 1883, pp. 100, 145, 252, 344.
J. P. Iddings: *Journ. Geol.*, i, 1893, p. 166.
J. W. Sollas: *Rocks of Cape Colville Peninsula, New Zealand*, 1905.
Mem. Geol. Surv. Scot. 53 (Ben Nevis and Glen Coe), 1916, p. 180.

Angrite.—An achondritic meteoritic stone consisting mainly of purple titaniferous augite (over 90 per cent.) and olivine.

Anhedral, *Pirsson*, 1895.—See **Allotriomorphic.**

Anhedron, *Pirsson*, 1895.—A term applied to crystals which have failed to develop the faces naturally suggested by the term *crystal*.

L. V. Pirsson: *Bull. Geol. Soc. Am.*, vii, 1895, 492.

Ankaramite, *Lacroix*, 1916.—A melanocratic basaltic rock, poor in plagioclase and richer in augite than in olivine = *felspathic augitite*.

(Ankaramy, Madagascar.)

A. Lacroix: *C.R.*, clxiii, 1916, p. 182.

Ankaratrite, *Lacroix*, 1916. — Melanocratic forms of nepheline-basalt with phenocrysts of olivine; some varieties contain melilite.

(Mt. Ankaratra, Madagascar.)

A. Lacroix: *C.R.*, clxiii, 1916, p. 256.

Anorthite-basalt, *Wada*, 1882.—A variety of basalt, containing anorthite (An_{90}-An_{100}) as the essential felspathic mineral. (Fuji Yama, Japan.)

Anorthite Rock, *Irving*, 1883. — A variety of anorthosite, consisting mainly of anorthite.

(L. Superior, Minnesota.)

R. D. Irving: *U.S.G.S., Mon.* v, 1883, p. 59.

Anorthosite, *Sterry Hunt*, 1863. — A leucocratic gabbro or norite, nearly free from pyroxene, and thus composed essentially of a plagioclase (*Fr.* =*anorthose*), which is usually not less calcic than labradorite.

N. L. Bowen : *Journ. Geol.*, xxv, 1917, p. 209.

Anthracite. — A variety of coal, containing less than 10 per cent. of volatile matter and over 90 per cent. of carbon, and which therefore burns slowly with a smokeless flame. Anthracite can be handled without soiling the fingers and has a high lustre.

A. Strahan : *Mem. Geol. Surv.* (Coals, S. Wales), 1915, p. 73.

Anthraconite. — A term applied to black bituminous limestones or marbles.

Anthraxolite. — A coal-like and lustrous variety of bitumen; H = 3 – 4; S.G. = nearly 2. The same term has also been used to describe bituminous and anthracitic matter occurring as enclosures in igneous rocks.

Anti-stress Minerals, *Harker*, 1918. — A term suggested for minerals such as anorthite, potash-felspars, pyroxenes, forsterite, andalusite, etc., whose formation in metamorphosed rocks is favoured by conditions controlled, not by shearing stress, but by thermal action and hydrostatic pressure; contrasted with *stress-minerals* (q.v.).

A. Harker : *Q.J.G.S.*, lxxiv, 1918, p. lxxviii.

Apachite, *Osann*, 1896.—A variety of nepheline-phonolite, rich in alkali-pyroxenes and amphiboles.

(Apache Mts., Texas.)

Aphanite, *Haüy*, 1822.—A term first applied to compact rocks of dioritic composition; now extended to any fine-grained igneous rock or groundmass (said to be *aphanitic*), the constituents of which cannot be distinguished by the unaided eye.

Aphrolith, *Jaggar*, 1917. — A term, meaning "foam-stone," applied to block-lava or *aa*-lava.

T. A. Jaggar : *Jour. Wash. Acad. Sci.*, vii, 1917.

Aplite, *Retz.* — A leucocratic microgranite occurring as dykes or contemporaneous veins; muscovite may be present. Sometimes written *Haplite.*

Aplodiorite, *Bailey*, 1916. — A leucocratic variety of biotite-granodiorite containing little or no hornblende.

E. B. Bailey: *Mem. Geol. Surv. Scotland*, 53 (Ben Nevis & Glen Coe), 1916, pp. 160, 166.

Aplogranite, *Bailey*, 1916. — A term for leucocratic rocks of granitic texture consisting essentially of alkali-felspar and quartz, with subordinate biotite; muscovite may be present or absent.

E. B. Bailey: *Mem. Geol. Surv. Scotland*, 53 (Ben Nevis & Glen Coe), 1916, p. 158.

Apo-.—A prefix implying the derivation of one kind of rock from another; applied specifically to the names of volcanic rocks to indicate that they have suffered devitrification, *e.g., aporhyolite.* Van Hise proposed *aposandstone* for quartzite, *apogrit* for grauwacke, and other analogous terms.

F. Bascom: *Journ. Geol.*, i, 1893, p. 828.
C. R. Van Hise: *U.S.G.S. Mon.* 47, 1904, p. 776.

Apophyses. — Veins, tongues, or dykes that can be directly traced to larger intrusions, from which they are offshoots.

Appinite, *Bailey*, 1916. — A group term for melanocratic varieties of syenite, monzonite or diorite, which are rich in hornblende; like the vogesites and spessartites, of which appinite is regarded as the "plutonic" equivalent, secondary minerals are generally present. (Appin, Loch Linnhe.)

Mem. Geol. Surv. Scot., 53 (Ben Nevis and Glen Coe), 1916, pp. 167-8.

Aqueo-igneous.—A term applied to minerals which are of magmatic origin, and yet are not strictly pyrogenetic because of their deposition from solutions, which, though late-magmatic, are rich in water. Amygdales and pegmatites afford examples. Applied also to rocks formed of such minerals and to the processes operative in their formation.

Arapahite, *Washington & Larsen,* 1913. — A melanocratic variety of basalt, containing about 50 per cent. of magnetite.

H. S. Washington & E. S. Larsen: *Journ. Wash. Acad. Sci.,* iii, 1913, p. 449.

Arctic Suite, *v. Wolff,* 1914.—A general term for the basaltic and associated rocks of the Brito-Arctic province, drawing attention to the fact that they do not clearly belong to either the Atlantic or the Pacific suite, but occupy a petrographic position of an intermediate character corresponding with their geographical situation between the alkali-rocks of the Atlantic Islands and the andesitic-rocks of the Pacific Borders.

F. v. Wolff: *Der Vulkanismus,* Bd. I (2), 1914, p. 427.
A. Holmes: *Min. Mag.,* xviii, 1918, p. 180.

Arenaceous = Psammitic. — Terms applied to sedimentary rocks composed of grains of sand, loose or cemented.

Argillaceous = Pelitic.—Terms applied to sedimentary rocks characterised by an abundance of clay minerals, and a predominance of the "mud" grades.

W. M. Hutchings: *Geol. Mag.,* 1890, pp. 264, 316: 1891, p. 164; 1892, pp. 154, 218; 1894, pp. 36, 64; 1896, pp. 309, 343.

Argillite.—An argillaceous rock cemented by silica, and therefore more compact and less clearly laminated than shale.

Ariégite, *Lacroix,* 1901.—A type of pyroxenite rich in alumina, containing variable amounts of spinel, pyrope, and sometimes of hornblende.

(Ariége, Pyrenees.)

A. Lacroix: *Cong. Géol. Inter., C.R.* viii (Paris, 1900), 1901, p. 807.

Arizonite, *Spurr & Washington,* 1917. — A dyke rock, containing 80 per cent. of quartz and 18 per cent. of orthoclase. (Arizona.)

Arkite, *Washington,* 1901. — A holocrystalline porphyritic rock), composed of leucite (or pseudoleucite), nepheline, ægirine-augite and melanite.

(Magnet Cove, *Ark*ansas.)

H. S. Washington: *Journ. Geol.,* ix, 1901, p. 615.

Arkose, *Brongniart,* 1823. — A coarse-grained richly-felspathic sandstone or grit, derived from the rapid disintegration of granite or gneiss. Arkose thus differs from felspathic grit and sandstone by containing a high percentage of felspar which has suffered little, if any, alteration by weathering.

D. C. Barton: *Journ. Geol.,* xxiv, 1916, p. 417.

Arso Trachyte.—A type of olivine-trachyandesite containing phenocrysts of sanidine, oligoclase, augite and olivine in a trachytic groundmass containing interstitial glass. The type is thus related to rhomb-porphyry and kenyte.

(Lava of 1302, Ischia.)

Articulite, *Wetherell,* 1867. = *Flexible Sandstone.*

Aschaffite, *Gümbel,* 1865.—A lamprophyric dyke-rock containing quartz and plagioclase, with abundant biotite among the femic minerals.

(Aschaffenburg, Bavaria.)

Aschistic, *Brögger,* 1894. — A term applied to those rocks of minor intrusions which have not suffered differentiation into leucocratic and melanocratic modifications, but which have nearly the same composition as the larger intrusions with which they are associated.

Ash, Volcanic. — Fine-grained pyroclastic material composed of comminuted glass, crystals, and/or cryptocrystalline or microcrystalline rock substance. The term is, however, becoming obsolete, partly because of its ordinary connotation, and partly because in British literature it has not been confined to fine-grained material, but has been used synonymously with *Tuff.*

Asphalt.—A black, glossy, and brittle variety of bitumen.

G. H. Eldridge : *U.S.G.S. 22nd Ann. Rep.*, Pt. i, 1901, p. 222.

H. Kohler : *Die Chemie und Technologie der Natürlichen und Künstlichen Asphalte*, 1913.

H. Abraham : *Asphalts and Allied Substances*, 1918.

Asphaltite. — A group-term sometimes used for the solid forms of the purer bitumens, such as albertite, grahamite, and uintaite, to distinguish them from bituminous sands and limestones, which commercially are often described as "asphalt."

Assimilation, *Michel-Lévy*, 1893. — The process whereby material from the containing walls of an intrusion is absorbed by solution in the invading magma, either *in situ* (or nearly so) at the contacts, or in depth, by the sinking through the magma of blocks or fragments stoped from the roof.

W. J. Miller : *Bull. Geol. Soc. Am.*, xxv, 1914, p. 243.

R. A. Daly : *Igneous Rocks and their Origin*, 1914.

—— *Journ. Geol.*, xxvi, 1918, p. 126.

Assyntite, *Shand*, 1909.—A variety of augite-bearing sodalite-syenite. (Assynt, N.W. Highlands.)

S. J. Shand : *Trans. Edin. Geol. Soc.*, ix, 1910, p. 403.

Asthenosphere, *Barrell*, 1914. — A thick zone lying beneath the more rigid lithosphere; in which plasticity reaches a maximum, in which isostatic and other readjustments are effected, and in which magmas may be generated.

J. Barrell : *Journ. Geol.*, xxii, 1914, p. 680; and xxiii, 1915, p. 425.

A. Holmes : *Geol. Mag.*, 1916, p. 267.

J. Barrell : *Am. Journ. Sci.*, xlviii, 1919, pp. 281, 291.

Astite, *Salomon*, 1898. — A variety of hornfels, in which mica and andalusite are the dominant minerals. (Cima d'Asta, Italian Alps.)

Atatschite, *Morozewicz*, 1901. — A variety of hyalo-orthophyre, characterised by the presence of small amounts of sillimanite, and locally of cordierite.

Orthoclase, augite and biotite occur as microscopic crystals in a glassy base.

(Atatsch Mt., Southern Urals.)

J. Morozewicz: *Mem. Comm. Géol. Russia*, xviii (1), 1901, p. 18.

Ataxic, *Keyes*, 1901.—A general term applied to unstratified ore-deposits, as opposed to those that are stratified, or *eutaxic*.

C. R. Keyes: *Trans. Amer. Inst. Min. Eng.*, xxx, 1901, p. 323.

Ataxite, *Lœwinson-Lessing*, 1888. — A brecciated or irregularly mottled composite volcanic rock, in which the broken fragments of one lava-flow are irregularly distributed in another. A similar structure to which the term may also be applied occurs in certain minor intrusions.

Ataxite, *Brezina*, 1896.—A general term for siderites (iron-meteorites) which contain less nickel than hexahedrites or more than octahedrites, and so fail to exhibit the structures characteristic of those types.

Atlantic Suite, *Harker*, 1896.—A general term for the whole assemblage of alkali-rocks, directing attention to their distribution in and around the Atlantic, to their association with the Atlantic type of coast-line, and more generally to their association with tectonic structures due to tension, fracture and differential radial movements. Cf. *Pacific Suite*. See *Alkali-rocks*.

G. T. Prior: *Min. Mag.*, xiii, 1903, p. 228.
A. Harker: *Nat. Hist. Ig. Rocks*, 1909, p. 90.
J. S. Flett: *Geol. Mag.*, 1912, p. 517.
J. W. Gregory: *Scientia*, xi, 1912, p. 56.
A. Holmes: *Geol. Mag.*, 1916, p. 272; *Geol. Mag.*, xviii, 1918, p. 220.

Aubrite, *Prior*, 1919. — A group name for enstatite achondrites, including Aubres, Bishopville and Bustee. Cf. *Chladnite*.

Auganite, *Winchell*, 1912. — A term suggested for augite-andesite to avoid the use of a compound name.

A. N. Winchell : *Journ. Geol.*, xxi, 1913, p. 215.

Augen-gneiss. — A general term for gneissose rocks, independently of their origin, containing "eyes," *i.e.*, phacoidal or lenticular crystals, or aggregates, which simulate the porphyritic crystals of igneous rocks. The "eyes" may be *porphyroblastic* or *blasto-porphyritic* crystals, or, in the case of composite gneisses, porphyritic crystals belonging to the injected component of the rock.

Augen-schist, *Lapworth*, 1885. — A rock associated with mylonite, and composed of granulated minerals, aggregates of which occur as "augen," surrounded by and alternating with schistose streaks and lenticles of completely recrystallised minerals. In mylonite the rolling out has been effected with but little recrystallisation. Cf. *Mylonite-gneiss.*

C. Lapworth : *Nature*, 1885, p. 559.

Augitite, *Doelter*, 1882.—A volcanic rock, containing phenocrysts of augite and iron-ore, with or without biotite or hornblende, in a base of brown glass, which is usually a soda-rich variety. = *Magma basalt* (in part).

Aureole. — A term applied to the zone of contact-metamorphosed rocks surrounding an intrusion.

Australite.—A term used to distinguish the obsidianites of Australia from those of Bohemia (Moldavites) and Billiton (Billitonites). Cf. *Obsidianite.*

H. S. Summers : *Aust. Ass. Ad. Sci.* (Melbourne, 1913), xiv, 1914, p. 189.

C. G. Thorpe : *Nat. Hist. and Sci. Soc. W. Australia*, 1914, p. 20.

E. W. Skeats : *Proc. Roy. Soc. Victoria*, xxvii, 1915, p. 362.

Authigenous, or **Authigenic,** *Kalkovsky*, 1880.—Terms, meaning *generated on the spot*, applied to those constituents that came into existence with or after the formation of the rock of which they

constitute a part; *e.g.*, the primary and secondary minerals of igneous rocks, and the cements of sedimentary rocks. Cf. *Allothigenous*.

Autochthonous, *Gümbel*, 1888. — A term applied to rocks such as rock-salt and stalactite, denoting that they and their constituents have been formed *in situ*. Cf. *Allochthonous*.

Autoclastic, *Van Hise*, 1894.—A term applied to rocks that have been brecciated in place by mechanical processes, *e.g.*, *crush breccias*.

Autolith, *Holland*.—A fragment of igneous rock enclosed in another igneous rock of later consolidation, each being regarded as a derivative from a common parent magma. = *Cognate Inclusion*.

T. H. Holland: *Mem. Geol. Surv. India,* xxviii, 1900, p. 217.

Autometamorphism, *Sargent,* 1917.—The metamorphism of an igneous rock by the action of its own volatile fluxes; *e.g.*, the formation of *spilite* from basalt. Cf. *Autopneumatolysis*.

H. C. Sargent: *Q.J.G.S.*, lxxiii, 1917-18, p. 19.

Automorphic, *Rohrbach,* 1886. — See **Idiomorphic.**

Autopneumatolysis, *Lacroix*, 1907.—The production of new minerals in an igneous rock by the action of its own mineralising agents; *e.g.*, the formation of sanidine, sodalite, biotite, etc., in the leucite-tephrites of Vesuvius.

A. Lacroix: *Nouv. Arch. du Mus. d'Hist. Nat.*, ix, 1907, p. 109.

Avezacite, *Lacroix*, 1901.—A phanerocrystalline dyke rock, composed of augite and hornblende, with titaniferous iron-ore, apatite, and sphene as abundant accessories. The type-rock is cataclastic in structure. (Avezac, Pyrenees.)

A. Lacroix: *Cong. Geol. Inter., C.R.*, viii (1900), 1901, p. 832.

Aviolite, *Salomon,* 1898.—A variety of hornfels, consisting essentially of mica and cordierite.

(Monte Aviolo, Italian Alps.)

Axiolitic, *Zirkel*, 1876. — A term applied to a composite spherulitic texture, in which the spherulitic bodies are elongated along a central axis, to which the radiating fibres are normal.

B

Bahiaite, *Washington*, 1914.—A variety of hypersthenite, containing abundant hornblende with smaller amounts of olivine and pleonaste.

(Bahia, Brazil.)

H. S. Washington: *Am. Journ. Sci.*, xxxviii, 1914, p. 86.

Ballstone. — A Shropshire term for an irregular lenticular mass of unstratified limestone occurring in the Wenlock and other Palæozoic limestones. Examples vary in dimensions up to 60 feet or more, and are found to consist of colonies of corals and stromatoporoids (in the position of growth) enveloped in a matrix of calcareous mud.

M. C. Crossfield & M. S. Johnston: *Proc. Geol. Assoc.*, xxv, 1914, p. 193.

Banakite, *Iddings*, 1895.—A variety of trachydolerite similar mineralogically to absarokite but containing less olivine and augite, and in some varieties being free from olivine, or even containing quartz.

(Yellowstone Park.)

J. P. Iddings: *Journ. Geol.*, iii, 1895, p. 947.

Banatite, *v. Cotta.*—An orthoclase-bearing variety of augite-quartz-diorite. (Banat.)

Bandaite, *Iddings*, 1913.—A general term for "labradorite-dacites"; *i.e.*, for quartz-basalts which in texture resemble dacites or andesites.

(Bandai San, Japan.)

Banded Structure.—A structure developed in many igneous and metamorphic rocks, due to the alternation of layers which differ conspicuously in mineral composition or texture, or both.

F. F. Grout: *Journ. Geol.*, xxvi, 1918, p. 439.

Banket.—A term of Dutch origin originally applied to the auriferous Witwatersrand conglomerates, and now used more widely for other compact siliceous vein-quartz conglomerates, which have pebbles of about the size of a pigeon's egg, and in general possess the megascopic characters of the type-rock from the Rand.

R. B. Young : *The Banket*, London, 1917.
W. H. Goodchild : *Mining Mag.*, xix, 1918, p. 194.

Barolite, *Wadsworth*, 1891. — A term suggested for rocks composed of barytes or celestine.

Basalt.—A microlithic or porphyritic igneous rock of a lava flow or minor intrusion, often vesicular or amygdaloidal, having an aphanitic texture as a whole or in the groundmass, and composed essentially of plagioclase (at least as calcic as labradorite), and pyroxene, with or without interstitial glass. When olivine is present the rock is termed an *olivine-basalt*. In the field the term *basalt* is generally applied only to lava flows, the corresponding rocks of minor intrusions being called *dolerite*. The original distinction between basalt and dolerite was based simply on degree of granularity, basalt being a compact rock, while dolerite was recognisably crystalline, *i.e.*, the component minerals were sufficiently large to reflect light individually, even though they were too small for determination.

A. Harker : *Mem. Geol. Surv. Scot.* (Tert. Ig. Rocks Skye), 1904, p. 29.
H. S. Washington : *Q.J.G.S.*, lxiii, 1907, p. 69 (Mediterranean).
Mem. Geol. Surv. Scot. (Glasgow District), 1911, p. 135.
G. W. Tyrrell : *Trans. Geol. Soc. Glas.*, xiv, 1912, p. 219 (Midland Valley).
W. Cross : *U.S.G.S., Prof. Pap.*, 88, 1915 (Hawaii).
A. Holmes : *Q.J.G.S.*, lxxii, 1916, p. 260 (E. Africa).
O. Bäckström : *Bull. Geol. Inst. Univ. Upsala*, xiii, 1916, p. 115 (Antarctica).
A. Holmes : *Min. Mag.*, xviii, 1918, p. 180 (Arctic).

Basaltite.—An old term revived by the International Congress in 1900, and adopted to denote basalts without olivine.

Basanite, *Brongniart,* 1813.—A basaltic rock, generally porphyritic, containing plagioclase, augite, olivine, and a felspathoid; nepheline-, leucite-, and analcite-basanites are distinguished. In the original usage of the term, olivine was not necessarily an essential component. The type is now, however, distinguished from tephrite by the presence of olivine.

Basanitoid, *Bücking,* 1881. — A term used for alkali-basalts free from nepheline, but containing a soda-rich isotropic base. By Lacroix it has been more recently defined as a basaltic rock having the chemical composition of basanite, but free from felspathoids.

A. Lacroix : *C.R.*, clxix, 1919, p. 402.

Basic.—A term applied to igneous rocks having a relatively low percentage of silica, the limit below which they are regarded as basic being about 52 per cent. Cf. *subsilicic* and *undersaturated.*

Basis.—See **Mesostasis.**

Batholith, *Suess,* 1888.—A large transgressive intrusion with sides generally steeply inclined, and with no visible or determinable floor. Smaller intrusions of similar relations are variously called *Stocks, Bosses,* or *Domes.*

R. A. Daly : *Igneous Rocks and their Origin,* 1914, p. 89.

Batukite, *Iddings & Morley,* 1917.—A porphyritic volcanic rock containing phenocrysts of augite and fewer of olivine, in a groundmass of augite, magnetite, and leucite. The rock is thus a melanocratic leucite-basalt. (Batuku, Celebes.)

J. P. Iddings & E. W. Morley : *Proc. Nat. Acad. Sci.,* iii, 1917, p. 595.

Bauxite, *Dufrenoy,* 1847. — An amorphous mineral having the composition represented by $Al_2O_3.2H_2O$. The name is also applied com-

mercially to aluminous lateritic rocks in which aluminium hydroxides, amorphous or crystalline, predominate over other lateritic constituents. Further confusion has been introduced by proposals (*a*) to use *bauxitite* (*Dittler and Doelter,* 1912) for a rock mainly composed of bauxite, and (*b*) to use *bauxitite* (*Campbell,* 1917) for the mineral bauxite as defined above. The latter usage is clearly inadmissible, and the former serves little purpose, as most of the rocks referred to as bauxite contain very little of the mineral properly so called, though many of them correspond to it in their bulk chemical composition on account of the presence of both $Al_2O_3.H_2O$ and $Al_2O_3.3H_2O$.

W. J. Mead : *Econ. Geol.,* x, 1915, p. 28.
T. L. Watson : *Geol. Surv. Georgia, Bull.* 11, 1916.
J. Morrow Campbell : *Mining Mag.,* 1917, p. 171.

Bean Ore.—A loose pisolitic iron ore of Tertiary age ; distinguished from *minette* by the larger size of the pisolitic grains.

Becke Method.—A microscopic method of determining which of two materials in contact has the higher or lower average refractive index. The amount of illumination is reduced and the focus adjusted until the contact between a mineral with liquid, Canada balsam, or another mineral appears as a relatively bright line. On raising the objective a band of illumination moves into the material having the higher refractive index ; while on lowering the objective the band moves into the substance with the lower index.

Beerbachite, *Chelius,* 1894. — A fine-grained gabbro, often leucocratic, occurring in aplite-like veins or dykes ; composed essentially of labradorite and diallage, with hypersthene and magnetite.

Bekinkinite, *Rosenbusch,* 1907.—A melanocratic rock containing titanaugite with nepheline and a little felspar as essential minerals. Soda-amphibole, biotite and analcite are often present and most ex-

amples are olivine-bearing. By Lacroix *bekinkinite* is regarded as a variety of theralite in which the dominant white mineral is analcite.

(Bekinkina, Madagascar.)

G. W. Tyrrell: *Geol. Mag.*, 1915, pp. 304 and 361.
A. Lacroix: *C.R.*, clxx, 1920, p. 20.

Belonite, *Vogelsang*, 1872.—A needle-shaped crystallite with pointed or rounded ends.

Belugite, *Spurr*, 1900.—A term applied to rocks intermediate (in respect of their felspar) between diorite and gabbro; *i.e.*, containing andesine and/or labradorite. (Beluga River, Alaska.)

J. E. Spurr: *Amer. Geol.*, xxv, 1900, p. 233.

Bentonite.—A white clay-like rock largely composed of colloidal silica and characterised by its capacity for absorbing large quantities of water.

(Rosedale Mine, Alberta.)

Beresite, *Rose*, 1840.—A quartz-rich variety of aplite, often characterised by the presence of pyrite.

(Beresovsk, Urals.)

J. E. Spurr: *Am. Journ. Sci.*, x, 1900, p. 358; *U.S.G.S. 20th Ann. Rep.*, Pt. vii, 1900, p. 195.

Bergalite, *Sœllner*, 1913. — A black pitch-like dyke rock containing small phenocrysts of haüyne, apatite, perovskite, melilite, and magnetite, in a groundmass of the same minerals with nepheline and biotite and brown interstitial glass

(Kaiserstuhl, Baden.)

Beringite, *Harzinski*, 1912. — A melanocratic variety of soda-trachyte rich in barkevikite.

(Bering Is., Kamchatka.)

Bermudite, *Pirsson*, 1914. — A lamprophyric volcanic rock containing abundant small biotite crystals, with accessory iron-ores and apatite, in an obscure analcitic base. The type is thus the effusive equivalent of biotite-monchiquite or ouachitite. In some varieties augite (brown to colourless) is also present. (Bermuda Is.)

L. V. Pirsson: *Am. Journ. Sci.*, xxxviii, 1914. p. 340.

Berondrite, *Lacroix*, 1920.—A type of theralite characterised by the presence of elongated crystals of brown hornblende associated with titaniferous augite. Cf. *Luscladite.*

(R. Berondra, Madagascar.)

A. Lacroix : *C.R.*, clxx, 1920, p. 22.

Beschtauite, *Gerassimow*, 1910.—A soda-rich variety of quartz-porphyry ; = *quartz-keratophyre.*

(Mt. Beschtau, Caucasia.)

Billitonite, *F. Suess*, 1900. — A general term for the obsidianites of the Malay Peninsula and Archipelago. (Billiton.)

Binary Granite, *Keyes*, 1895.—A term applied originally to granites containing only the essential minerals quartz and felspar, but now used to connote granites which contain both the common micas, muscovite and biotite.

Bird's-Eye Slate. — A quarryman's term for slate crowded with squeezed concretions. The term *Bird's-eye* is given in Guernsey to a variety of diorite.

Birkremite, *Kolderup*, 1903. — A leucocratic quartz-syenite containing alkali-felspars, together with small amounts of quartz and hypersthene.

F. Lœwinson-Lessing : *Verh. Russ. Min. Ges. St. Pet.*, xlii, 1905, p. 262.

Bitumen.—A group name for natural substances composed of hydrocarbons, ranging in types from petroleum (mobile), through mineral tars (viscous), to asphalt (rigid).

G. H. Eldridge : *U.S.G.S. 22nd Ann. Rep.*, Pt. i, 1901, p. 222.

H. Köhler : *Die Chemie und Technolgie der Natürlichen und Künstlichen Asphalte*, 1913.

Black-band Ironstone. — A variety of *clay ironstone* containing sufficient carbonaceous matter to allow of calcining without the addition of fuel in a separate charge.

Blaes.—A Scottish name for carbonaceous shales of a grey-blue colour, associated in the Lothians with oil-shales. They differ from the latter in having a low content of bituminous matter, in being brittle rather than tough, and in weathering to a crumbling mass which passes into soft clay.

Mem. Geol. Surv. Scotland (Oil Shales, Lothians), 1912, p. 7.

Blairmorite, *MacKenzie*, 1919.—A porphyritic volcanic rock characterised by an abundance of analcite phenocrysts, in a groundmass of analcite, alkali-felspar and alkali-pyroxenes.

(Blairmore, Crowsnest Pass, Alberta.)

Geol. Surv. Canada, Museum Bull. No. 4, 1914, p. 19.

Blast.—A syllable indicating the process of recrystallisation in a highly viscous mass during the metamorphism of rocks. It is used as a suffix in terms like *idioblast* and *porphyroblast* to indicate the form or relations of individual crystals. The termination *-blastic* is used in words like *granoblastic* and *poikiloblastic* to denote the textures of the rocks produced. As a prefix, *blasto-*, it appears in terms like *blastophitic* and *blastoporphyritic* to connote a relict texture veiled, but not entirely destroyed by recrystallisation.

U. Grubenmann: *Die Kristallinen Schiefer*, 1, 1904.

Blasto-porphyritic, *Becke*, 1903. — A term applied to the textures of metamorphic rocks derived from porphyritic rocks, and in which the porphyritic character still remains as a relict feature, veiled but not obliterated by subsequent recrystallisation.

Block-lava.—A term applied to lava flows which occur as a tumultuous assemblage of angular blocks having extremely rough surfaces due to the abundant development of large vesicles; = *aa*-lava or *aphrolithic* lava.

Blue Ground.—A term applied to the slaty-blue or blue-green kimberlite-breccia of diamond pipes, occur-

ring beneath a superficial oxidised covering known as *Yellow Ground.* (Kimberley.)

P. A. Wagner : *The Diamond Fields of South Africa*, 1914 p. 26.

Blue Mud.—A common variety of deep-sea mud having a bluish-grey colour due to the presence of organic matter and finely-divided iron-sulphides; $CaCO_3$ present in variable amounts up to 35 per cent.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 229.

Bogen Structure, *Mügge.*—A term for the structure of vitric tuffs composed largely of shards and "bows" of glass, formed by the explosive vesiculation of lavas, or by the breaking of pumice or other highly vesicular vitreous rocks.

Bog Iron Ore.—A general term for impure ferruginous deposits formed in bogs or swamps by the oxidising action of algæ, bacteria, or the atmosphere. In the presence of decaying vegetation, which acts as a reducing agent, siderite is deposited.

E. C. Harder : *U.S.G.S., Prof. Pap.* 113, 1919.

Bojite, *Weinschenk.* — A term suggested for hornblende-gabbros in general. The type rock contains augite and biotite in addition to hornblende.

Bole.—A bright-red, waxy or unctuous decomposition product of basaltic rocks, having the variable composition of lateritic clays.

Mem. Geol. Surv. Ireland (Interbasaltic Rocks), 1912, p. 18.

Bombs.—Ellipsoidal, discoidal, or irregularly rounded masses of lava ejected at a high temperature during a volcanic eruption. Bombs vary in size from that of the largest lapilli upwards. They are characterised by a well-defined crust, and are often cellular or even hollow, internally.

Boninite, *Petersen*, 1891.—A hyalo-andesite with occasional phenocrysts of andesine and hypersthene. (Bonin Is., Japan.)

Borolanite, *Teall,* 1892.—A phanerocrystalline igneous rock composed essentially of orthoclase and melanite with subordinate nepheline, biotite, and pyroxene. Orthoclase and nepheline (or sodalite) sometimes form rounded pseudo-porphyritic masses resembling leucite. (L. Borolan, Assynt.)

S. J. Shand : *Trans. Edin. Geol. Soc.,* ix, 1909, p. 202, and 1910, p. 376.

Boss.—A transgressive intrusion of igneous rock like a stock or dome. The term is also applied to forms of less regular outline than the latter, and is therefore of wider application.

Bostonite, *Rosenbusch,* 1882.—A leucocratic alkali-syenite-aplite with trachytic texture ; formed almost wholly of alkali-felspars. (Boston, Mass.)

Boulder Clay. — A tenacious unstratified deposit of glacial origin consisting of a stiff clay (rock flour) packed with subangular stones of varied sizes.

Bowenite.—A translucent variety of serpentine composed of a dense felt-like aggregate of colourless serpentine-fibres, with occasional patches of magnesite, flakes of talc, and grains of chromite. The rock occurs as veins in a foliated rock containing the same minerals, but with talc as the dominant constituent. (New Zealand.)

A. M. Finlayson : *Q.J.G.S.,* lxv, 1909, p. 361.

Bowralite, *Mawson,* 1906.—A pegmatoid rock consisting of idiomorphic sanidine with subordinate soda-amphibole (arfvedsonite) and ægirine. (Bowral, N.S. Wales.)

D. Mawson : *Proc. Linn. Soc. N.S.W.,* xxxi, 1906, p. 606.

Box-stones. — A local (Suffolk) name for masses of brown ferruginous or phosphatic sandstone, rounded or flattened in form, and in size generally a little larger than that of the closed fist. Some specimens are more concretionary than others, and, on being broken, are found to enclose fossil remains : hence the name.

P. G. H. Boswell : *Geol. Mag.,* 1915, p. 250.

Braccianite, *Lacroix*, 1917. — A variety of leucite-tephrite, having the chemical composition of certain leucitites. (Bracciano, Italy.)

A. Lacroix : *C.R.*, clxv, 1917, p. 1030.

Breccia.—A clastic rock made of coarse angular or sub-angular fragments of varied or uniform composition, and of either exogenetic (*e.g.*, scree or moraine breccias) or endogenetic origin (*e.g.*, volcanic or crush-breccias).

T. G. Bonney : *Q.J.G.S.*, lviii, 1902, p. 185.
W. H. Norton : *Journ. Geol.*, xxv, 1917, p. 160.

Bronzitite, *Lacroix*, 1894.—A rock composed wholly or almost wholly of bronzite.

A. Lacroix : *Nouv. Arch. Mus. d'Hist. Nat.*, vi, 1894, p. 304.

Brotocrystal, *Lane*, 1902.—A term applied to crystals having corroded or embayed outlines.

A. C. Lane : *Bull. Geol. Soc. Am.*, xiv, 1902, p. 386.

Brown Coal, see **Lignite.**—Brown coal is now distinguished chemically from bituminous coal by containing more than 10 per cent. of water; and from lignite by containing less than 20 per cent.

Buchite.—A vitrified rock produced from phyllite or other material by intense local heat due to contact with basalt magma, or to the thermal effects of friction in mylonised crush-belts.

J. S. Flett : *Mem. Geol. Surv. Scot.* (Oban), 1908, p. 129.

Buchnerite, *Wadsworth*, 1884.—A term for peridotites containing both monoclinic and orthorhombic pyroxenes. The term has not been adopted, as *Lherzolite* has priority.

Buchonite, *Sandberger*, 1872. — A variety of tephrite containing hornblende and biotite in addition to the usual minerals, plagioclase, nepheline, and augite.

Buhr-stone.—A name given to certain varieties of porous open-textured calcareous sandstones which, on account of the angular character of the grains, are suitable for millstones.

Bustite, *Tschermak*, 1883.—An achondritic meteorite composed essentially of enstatite, with small amounts of diopside and oligoclase, and a little nickel-iron. Cf. *Aubrite*.

Bysmalith, *Iddings*, 1898. — An injected intrusion bounded by faults, and having a roughly cylindrical or plug-like form.

J. P. Iddings: *Journ. Geol.*, vi, 1898, p. 704.

C

Calc-alkali Rocks.—A term applied to igneous rocks in which the proportions of lime and alkalies (in relation to the other constituents) are such that the dominant minerals are felspars, hornblende, and/or augite, specifically alkali-minerals such as felspathoids and soda-pyroxenes and amphiboles being absent. The term comprises such rocks as granodiorite, syenite, diorite, and gabbro, and their volcanic analogues, and excludes alkali and spilitic rocks, and most peridotites. The term is used rather loosely to contrast rocks that are not "alkaline" with those that are, and cannot be strictly limited by definition.

Calc-aphanite.—A doleritic or diabasic rock which has been largely replaced by carbonate-minerals.

Calc-flinta, *Barrow*.—A very fine-grained metamorphic rock of flinty aspect derived from a calcareous mudstone. The new minerals are in part due to pneumatolytic processes, and include felspars and calc-silicate-minerals, the latter being less abundant than in calc-silicate-hornfels.

G. Barrow & H. H. Thomas: *Min. Mag.*, xv, 1908, p. 113.
Mem. Geol. Surv., 347 (Bodmin and St. Austell), 1909, pp. 86 and 97.
Mem. Geol. Surv. 335-336 (Padstow and Camelford), 1910, p. 51.

Calciphyre, *Brongniart*, 1813.—A crystalline limestone containing conspicuous calc-silicate minerals such as forsterite, pyroxene, garnet, etc.

Calcite-trachyte, *Washington*, 1917. — A variety of trachyte containing over 10 per cent. of calcite, probably primary. (Bilbao, Spain.)

Calcrete, *Lamplugh*, 1902.—A term suggested for conglomerates formed by the cementation of superficial gravels by calcium carbonate. The term *Calcicrete* is suggested by Bonney as preferable.

G. W. Lamplugh : *Geol. Mag.*, 1902, p. 575.
—— *Mem. Geol. Surv. Ireland*, 112 (Dublin), 1903, p. 111.

Calc-schist, *Brongniart*, 1827. — A metamorphosed argillaceous limestone in which calcite has recrystallised in elongated or platy forms, rather than in the commoner granular forms, thus giving to the rock with the other products of metamorphism a schistose structure.

Calc-silicate-hornfels.—An old term for contact-metamorphic rocks of variable but generally fine grain, derived from marls and other calcareous sediments, and therefore containing a great variety of minerals, mostly calc-silicates.

Caliche. — A deposit occurring in the Chilian nitrate-fields consisting of alluvium cemented with sodium nitrate and chloride and other soluble salts. In places, owing to recrystallisation, high-grade saline layers nearly free from débris are associated with the normal type of the deposit.

J. T. Singewald & B. L. Miller : *Econ. Geol.*, xi, 1916, p. 103.

Campanite, *Lacroix*, 1912.—A sodi-potassic variety of leucite-tephrite sometimes containing large phenocrysts of leucite. (Mte. Somma.)

A. Lacroix : *C.R.*, clxv, 1917, p. 1030.

Camptonite, *Rosenbusch*, 1887.—A lamprophyre essentially composed of plagioclase (generally labradorite) and brown hornblende (generally barkevikite). (Campton, New Hampshire.)

J. S. Flett : *Trans. Roy. Soc. Edin.*, xxxix, 1900, p. 865.
V. Hackmann : *Bull. Comm. Géol. Finlande*, xlii, 1914.

Canada-Balsam.—A transparent and fluid oleo-resin yielded by a North American species of silver fir; used for mounting microscopic preparations and for cementing glass in optical instruments. Exposed to the air, Canada-balsam becomes brittle and discoloured, and its refractive index gradually increases. The average values for refractive index are 1.524 (uncooked), 1.538 (slightly undercooked), and 1.543 (overcooked). In slides 30 years old the value rarely exceeds 1.543; but for normally cooked balsam the refractive index is between 1.534 and 1.540.

A. Johannsen: *Journ. Geol.*, xx, 1912, p. 89.

Canadite, *Quensel*, 1913.—A nepheline-syenite containing albite or an albite-rich plagioclase as the principal felspar with abundant mafic minerals which contain lime and alumina (*i.e.*, normative anorthite); the type is intermediate between *albite-nepheline-syenite* and *shonkinite*.

(Almunge, Sweden, and Ontario, Canada.)

P. Quensel: *Bull. Geol. Inst. Upsala*, xii, 1913, p. 163.

Cancrinite-Syenite, *Törnebohm*, 1883.—A variety of felspathoid-syenite having cancrinite as the dominant felspathoid.

I. G. Sundell: *Bull. Comm. Géol. Finlande*, *No.* 16, 1905.

Canga.—A Brazilian term for a ferruginous breccia or conglomerate composed of fragments of hæmatite and itabirite cemented together by limonite or hæmatite, and occasionally by other lateritic constituents.

Cannel Coal.—A dull lustreless variety of coal which breaks with a conchoidal fracture. It is rich in volatile combustibles, and burns with a bright flame.

Mem. Geol. Surv., Spec. Rep. Mineral Resources of Great Britain, vii. 1918.

Cantalite, *Dufrénoy*, 1845. — A variety of rhyolite-pitchstone. (Cantal.)

A. Lacroix: *C.R.*, 163, 1916, p. 407.

Carmeloite, *Lawson*, 1893.—A variety of augite-andesite or basalt (according as the plagioclase is andesine or labradorite) characterised by the presence of iddingsite. (Carmelo Bay, California.)

A. C. Lawson: *Bull. Dept. Geol. Univ. California*, i, p. 38, 1893.

Cascadite, *Pirsson*, 1905.—A lamprophyre (=*olivine-augite-minette*) with abundant phenocrysts of biotite and fewer of olivine and augite in a groundmass principally composed of alkali-felspar.

(Highwood Mts., Montana.)

L. V. Pirsson: *U.S.G.S., Bull.* 237, 1905, p. 109.

Cataclastic, *Kjerulf.*—A term applied to the structures produced in a rock by the action of severe mechanical stress during dynamic metamorphism, characteristic features being the deformation and granulation of the minerals. The term is also applied to rocks characterised by such structures.

Cataclastic, *Teall*, 1887.—A term applied to clastic rocks, the fragments of which have been produced by the fracture of pre-existing rocks by earth-stresses; *e.g.*, *crush breccias.*

Catapleiite-syenite, *Törnebohm*, 1906.—A porphyritic rock of tinguaite-habit containing phenocrysts of catapleiite, and occasionally of eudialyte, in an aphanitic but holocrystalline groundmass composed of those minerals with alkali-felspars, nepheline, and ægirine.

(Korra Kärr, Sweden.)

A. E. Törnebohm: *Sveriges Geol. Unders.*, Ser. C., No. 199, 1906.

Catawberite, *Lieber.*—A metamorphic rock consisting mainly of talc and magnetite. (S. Carolina.)

Catlinite.—A red variety of siliceous clay occurring in Minnesota.

Cauldron-subsidence.—The sinking of part of the roof of an intrusion within a closed system of peripheral faults up which magmas have penetrated.

C. T. Clough, H. B. Maufe & E. B. Bailey: *Q.J.G.S.*, lxv, 1909, p. 611.

E. B. Bailey: *Geol. Mag.*, 1919, p. 466.

Cecilite, *Cordier*, 1868.—A variety of leucitite characterised by an abundance of melilite.

H. S. Washington: *Carnegie Inst. Wash. Pub.*, 57, 1906, p. 138.

Celyphitic, see **Kelyphitic.**

Cement.—A term applied, as in mortar and concrete, to the material binding together the allogenic fragments or particles of clastic rocks. The term is not used for the groundmass, matrix, or base of igneous rocks. The process of *cementation* is the filling of interstices in porous or shattered rocks.

Cenotypal, *Brögger*, 1894.—A general term applied to aphanitic and porphyritic igneous rocks having the *habit* or suite of characteristics typical of fresh or nearly-fresh volcanic rocks such as those of Recent and Tertiary age. Crystals are lustrous, and glass, where present, has not lost its brilliancy by devitrification; whereas in the older rocks felspars and glass have become dull and lustreless by decomposition and devitrification. Rocks having the older-looking, dense and compact habit are described as *paleotypal*. The two terms constitute an attempt to express the essential differences between the two groups of aphanitic rocks variously distinguished as Tertiary and pre-Tertiary, fresh and altered, hypabyssal and volcanic: differences that are recognised in the nomenclature of rocks by two groups of terms such as *rhyolite* and *quartz-porphyry*, *andesite* and *porphyrite*, *basalt* and *diabase*.

Centric, *Becke*, 1878.—A textural term applied to the arrangement of crystalline matter in regular

groups around or about a centre, as in spherulites, variolites, oolites, etc.

Ceratophyre, see **Keratophyre.**

Chadacrysts, *Iddings,* 1909.—The relatively small crystals scattered as poikilitic inclusions through a host crystal (*oikocryst*) of another mineral.

Chalk.—A fine-grained somewhat friable foraminiferal limestone of Cretaceous age occurring in Britain, north-western Europe and elsewhere.

Mem. Geol. Surv. (Cretaceous Rocks of Britain), Vol. 2, 1903, p. 499; Vol. 3, 1904, p. 302.

Charnockite, *Holland,* 1893. — A granular variety of hypersthene-granite, composed of hypersthene, microcline-perthite, quartz and iron-ores. "Named after Job Charnock, the founder of Calcutta, whose tombstone (1695) was the first specimen of the rock described."

T. H. Holland: *Mem. Geol. Surv. India,* xxviii, Pt. 2, 1900, p. 134.
H. S. Washington: *Am. Journ. Sci.,* **xli,** 1916, p. 323.
F. L. Stillwell: *Aust. Ant. Exped. Sci. Rep. A,* iii 1 (1) (Met. Rocks, Adelie Land), 1918, p. 193.

Charnockite Series, *Holland,* 1900.—A series of rocks resembling the pyroxene-granulites of Saxony, ranging from *charnockite* through norite-like types to pyroxenite and characterised throughout by the presence of hypersthene.

Chassignite, *Rose,* 1863. — An achondritic meteorite essentially composed of olivine (enclosing chromite); nickel-iron is absent, and the type thus resembles the terrestrial dunite.

Chert.—A more or less pure siliceous rock composed in part of fibrous and radial chalcedony with or without the remains of siliceous and other organisms such as sponge spicules or radiolaria; occurring as independent formations and also as nodules and irregular concretions in formations (generally calcareous) other than the Chalk. The fracture is

generally splintery rather than conchoidal. Cf. *Flint*.

W. Hill: *Proc. Geol. Assoc.*, xxii, 1911, p. 61.
E. F. Davis: *Bull. Dept. Geol. Univ. California*, xi, p. 235, 1918.

Chiastolite-slate.—A contact metamorphic rock, generally free from conspicuous cleavage or schistosity, formed from carbonaceous shales, and containing conspicuous crystals of chiastolite in a generally cryptocrystalline groundmass.

Mem. Geol. Surv., 338 (Dartmoor), 1912, pp. 46 and 52.
A. Brammall: *Geol. Mag.*, 1915, p. 224.

Chibinite, *Ramsay*, 1894. — A coarse-grained variety of eudialyte-syenite in which soda-amphiboles are more abundant than soda-pyroxenes. It differs from lujaurite in having a more granular texture, and in containing rather less nepheline.

(Finland.)

W. Ramsay: *Fennia*, xv, 2, p. 15.

China-clay.—Although some ambiguity still exists as to the exact use of the term china-clay, it is now customary to regard it as a commercial term for the clay obtained from *China-clay Rock* after washing. In Europe the term *kaolin* is sometimes used for the clay both before and after washing. See *Kaolin*.

China-clay Rock.—A term applied to thoroughly kaolinised granite, essentially composed of quartz and kaolin, and in Cornwall containing also gilbertite and white mica, and often tourmaline; the rock is soft and can easily be crumbled in the fingers.

J. A. Howe: *Mem. Geol. Surv.* (Kaolin, China Clay and China Stone), 1914, p. 12.

China-stone.—A term applied to any firm granitic rock used in the manufacture of china, and usually, but not necessarily, kaolinised; the rock does not crumble readily like china-clay rock; Cornish varieties contain white mica and fluorite.

J. A. Howe: *Mem. Geol. Surv.* (Kaolin, China Clay and China Stone), 1914, p. 135.

Chladnite, *Rose*, 1863.—A group name for achondritic meteorites composed essentially of enstatite. Brezina extended the term to include bronzite stones of the diogenite group. To avoid confusion Prior proposes the term *Aubrite* to replace *Chladnite* as used by Rose and Tschermak.

Chlorite-schist. — A schist composed largely of chlorite, the foliation being due to the parallel disposition of the flakes. Other minerals are generally present, such as quartz, epidote, magnetite and garnet, the two latter being often in conspicuous idiomorphic crystals (porphyroblastic texture).

Chloritisation. — The sum of the processes whereby mafic minerals are altered to minerals of the chlorite group, or whereby any minerals are replaced by chlorite.

G. H. Williams: *U.S.G.S. Bull.*, 62, 1890.

Chlorophyre, *Dumont.* — A green variety of quartz-diorite-porphyrite occurring at Lessines, Belgium.

Chondrite, *Rose*, 1864.—A general term for meteoric stones which contain *chondrules* (see below) embedded in a finely crystalline matrix consisting essentially of pyroxenes (mainly enstatite or bronzite), olivine, and nickel-iron with accessory troilite, chromite and oligoclase. Glass (? maskelynite) is sometimes present, and in the chondrules may even become abundant. On the basis of the ratio MgO/FeO in magnesium silicates and the ratio Fe/Ni in nickel-iron, Prior has divided chondrites into four groups containing respectively the following percentages of nickel-iron: over 20; between 20 and 10, between 10 and 6 and less than 6. In these groups the proportion of nickel steadily increases as the percentage of nickel-iron decreases. See Table on p. 284.

G. T. Prior: *Min. Mag.*, xviii, 1916, p. 26.

Chondrules, *Rose*, 1864. — Spheroidal aggregates, often radiated in texture, varying in size from microscopic dimensions to about that of a walnut, which occur in many stony meteorites. The chief minerals present are orthorhombic pyroxene and olivine, with variable amounts of nickel-iron, troilite, and oligoclase; in some cases glass (? maskelynite) of felspathic composition is an abundant constituent.

Chonolith, *Daly*, 1905.—A general term for injected igneous intrusions, having shapes so irregular or relations to the invaded formations so complex that terms like *dyke, laccolith, bysmalith,* etc., are not applicable.

R. A. Daly : *Igneous Rocks and their Origin,* 1914, p. 84.

Chrome-chert, *Fermor,* 1919. — A variety of chert which has replaced the silicate-minerals of a chromite-peridotite, the more resistant chromite grains remaining unaltered in the secondary siliceous matrix. (Singhbhum, India.)

L. L. Fermor.: *Proc. Asiatic Soc. Bengal*, xv, 1919, p. clxxxiv.

Ciminite, *Washington,* 1896.—An olivine trachydolerite containing phenocrysts of augite, olivine, and orthoclase-mantled labradorite in a trachytic groundmass. (Mt. Cimini, Italy.)

H. S. Washington : *Journ. Geol.*, iv. 1896, p. 834.

Cipolino. — A marble rich in silicate minerals, and characterised more particularly by layers rich in micaceous minerals. In France the term *Cipolin* is used for crystalline limestones generally.

Clarain, *Stopes*, 1919. — A term suggested for the finely banded variety of "bright" coal. In bituminous coals it occurs as bands of variable thickness which have a smooth, shining surface when broken at right angles to the bedding plane. The type differs from *vitrain* in being minutely banded and containing intercalations of fine *durain*. In thin section clarain appears translucent

and shows a great variety of disintegrated plant substances, bands of spores and other constituents, the prevailing colours seen—when the section is sufficiently thin—being tints of yellow to reddish-amber.

Marie C. Stopes: *Proc. Roy. Soc. B.*, xc, 1919, pp. 474-5.

Class, *C.I.P.W.*, 1902.—A division of igneous rocks based on the relative proportions of the salic and femic standard normative minerals as calculated from chemical analyses. The descriptive terms used, *persalic*, *dosalic*, *salfemic*, *dofemic*, and *perfemic*, correspond to the terms *perfelsic*, *dofelsic*, *mafelsic*, *domafic*, and *permafic*, which are based on the relative proportions of the felsic and mafic minerals actually present. The division of igneous rocks into classes is analogous to the less rigid division into *hololeucocratic*, *leucocratic*, *mesocratic*, *melanocratic*, and *holomelanocratic* types.

Classification.—

Felspars—F. C. Calkins: *Journ. Geol.*, xxv, 1917, p. 157.
Igneous Intrusions—R. A. Daly: *Journ. Geol.*, xiii, 1905, p. 485.
Igneous Rocks—W. Cross: *Q.J.G.S.*, lxvi, 1910, p. 470.
A. Holmes: *Geol. Mag.*, 1917, p. 115.
Metamorphic Processes—R. A. Daly: *Bull. Geol. Soc. Am.* xxviii, 1917, p. 375.
Minerals—W. H. Emmons: *Econ. Geol.*, iii, 1908, p. 611.
E. T. Wherry & S. T. Gordon: *Proc. Acad. Nat. Sci., Philadelphia*, 1915, p. 426.
Rocks—T. Crook: *Min. Mag.*, xvii, 1914, p. 55.
Volcanic Exhalations—F. C. Lincoln: *Econ. Geol.*, ii, 1907, p. 258.

For additional references see under individual subjects.

Clastic.—A term applied to rocks composed of fragmental material derived from pre-existing rocks, or from the dispersed consolidation products of magmas (*e.g.*, in explosion-tuffs and flow-breccias). Cf. *autoclastic, epiclastic, cataclastic, pyroclastic.*

Clay. — An earthy deposit of extremely fine texture which is usually plastic when wet, and becomes hard and stone-like on being heated to redness. Chemically it is characterised by containing hydrous silicates of alumina in considerable quantity, with felspars and other silicates and quartz, and variable amounts of carbonates and ferruginous and organic matter. A proportion of the constituents is generally in the colloidal state, and then acts as a lubricant to the grains and flakes of non-colloidal material.

E. R. Buckley: *Wisconsin Geol. and Nat. Hist. Surv. Bull.*, vii, Pt. 1, 1901.
H. Ries: *Clays, Occurrence, Properties and Uses*, 2nd Ed., New York, 1908.
J. W. Mellor: *Trans. Ceramic Soc.*, viii, 1908.
H. E. Ashley: *U.S.G.S., Bull.* 388, 1909.
A. B. Searle: *British Clays, Shales and Sands*, London, 1911.
W. Salomon: *Geol. Rund.*, vi, 1916, p. 398.
N. B. Davis: *Trans. Amer. Inst. Min. Eng.*, li, 1916, p. 451.
W. S. Boulton: *Trans. Ceramic Soc.*, xvi, 1916-17, p. 237.
A. H. Cox: *Geol. Mag.*, 1918, p. 56.
H. S. Washington: *Journ. Am. Ceramic Soc.*, i, 1918, p. 405.
Additional papers will be found in the *Transactions of the Ceramic Society*.

Clay-ironstone.—A term applied to sheet-like deposits of concretionary masses of argillaceous siderite; associated with carbonaceous strata and particularly with the Coal Measures.

Clay Rock. — A term sometimes applied to indurated mudstones.

Clay-slate.—A variety of slate, the cleavage planes of which are free from the lustre found in slates that have attained a more crystalline condition, and thus approach phyllite. The term also distinguishes argillaceous slates from those derived from volcanic ash.

Claystone.—An obsolete term for an altered felspathic igneous rock, in which the whole rock or the

groundmass has been reduced to a compact mass of earthy or clayey alteration products.

Clay-with-Flints, *Whitaker*, 1861. — A deposit of mixed chalk-flints and clay that lies directly on the Chalk in many areas, and is often seen in pot-holes or pipes. It is usually ascribed to the effect of solution-weathering on chalk, but in many cases there may be an additional admixture of Tertiary materials. The clay is reddish or brown, very tenacious, and often nearly black at the base of the deposit, becoming lighter and more sandy higher up. Unfortunately the term has been loosely applied to almost all the clay-flint drift deposits that rest on the Chalk.

W. Whitaker : *Mem. Geol. Surv.* (Geology of London), Vol. 1, 1889, p. 281.
A. J. Jukes-Browne : *Q.J.G.S.*, lxii, 1906, p. 132.
R. L. Sherlock & A. H. Noble : *Q.J.G.S.*, lxviii, 1912, p. 199.
G. Barrow : *Proc. Geol. Assoc.*, xxx, 1919, p. 23.

Cleavage.—(a) The property of minerals, due to their atomic structure, whereby they can be readily separated along planes parallel to certain possible crystal faces. (b) The property of rocks such as slates, which have been subjected to orogenic pressure, whereby they can be split into thin sheets, the plane of cleavage being at right angles or inclined to the direction in which the pressure was applied, according to the effects produced by shearing-stress during the process.

A. Harker : *Rep. Brit. Assoc.*, 1885, p. 837.
G. F. Becker : *Journ. Geol.*, vi, 1896, p. 429.
C. K. Leith : *Structural Geology*, 1914, p. 84.

Coagulation.—A term applied to the process whereby a homogeneous suspension of a colloidal substance in a liquid settles down as a gelatinous mass; *i.e.*, the process whereby a *sol* passes into a *gel*. The corresponding change in the case of a suspension of minute granular material is termed *floculation*.

H. E. Ashley : *U.S.G.S. Bull.* 388, 1909, p. 15.

Coal.—A general name applied to black carbonaceous deposits, derived from accumulations of vegetable débris which have been compacted by diagenesis into firm brittle rocks exhibiting a dull or shining lustre.

E. C. Jeffrey : *Journ. Geol.*, xxiii, 1913, p. 218.
D. White & R. Thiessen : *U.S.A. Bureau of Mines, Bull.* 38, 1913.
A. Strahan & W. Pollard : *Mem. Geol. Surv.* (Coals, S. Wales), 1915.
W. Lomax : *Trans. Inst. Min. Eng.*, liii, 1917, p. 137.
G. Hickling : *Manchester Geol. and Min. Soc.*, 1918.
Marie C. Stopes & R. V. Wheeler : *The Constitution of Coal*, 1918.
Marie C. Stopes : *Proc. Roy. Soc. B.*, xc, 1919, p. 472.

Coal-balls. — Concretions of mineralised plant-débris occurring in certain coal-seams.

Marie C. Stopes & D. M. S. Watson : *Phil. Trans. Roy. Soc. B.*, cc, 1908, p. 167.

Coefficient of Acidity, *Vogt.*—The figure expressing the following ratio, calculated from the molecular proportions of the constituents of a rock or slag—

$$\frac{\textit{Number of atoms of oxygen in } SiO_2.}{\textit{Number of atoms of oxygen in the basic oxides.}}$$

Cognate Inclusions, *Harker,* 1900.—A term applied to xenocrysts or xenoliths occurring in an igneous rock to which they are genetically related; = *enclaves homœogènes* = *autoliths.*

A. Harker : *Journ. Geol.*, viii, 1900, p. 389.

Cokeite, *Lacroix*, 1910.—Natural coke formed by the action of magmas on coal, or by natural combustion of coal in mines.

A. Lacroix : *Min. de la France*, iv, 1910, p. 648.

Collobrierite, *Lacroix*, 1917. — A metamorphic rock composed of grunerite, fayalite, garnet, and magnetite. (Collobrieu, France.)

A. Lacroix : *Bull. Soc. franç. Min.*, xl, 1917, p. 62.

Colloids. — Microheterogeneous substances composed of two phases, one of which is dispersed through the other; *e.g.*, a jelly in which one phase forms a

continuous cellular framework, while the other, a liquid, occupies the pores.

Dispersed systems may be molecular, colloidal, or coarse; colloidal systems are defined as those in which the diameters of the dispersed particles lie between $1\mu\mu$ and $100\mu\mu$ (*i.e.*, 1/1,000,000 mm. and 1/10,000 mm.), and they are distinguished from molecular solutions by not dialysing, and from coarse dispersions by the fact that their individual particles cannot be distinguished microscopically. Liquid colloids are known as *sols*, and their coagulation products as *gels*. *Coagulation* is the result of a decrease in the degree of dispersion; *peptisation* that of an increase in the degree of dispersion. The following table gives examples of different types of dispersed systems :—

s = solid, l = liquid, g = gas — dispersed in a medium of — S = solid, L = liquid, G = gas.

System.	*Coarse.*	*Colloid.*	*Molecular.*
s + S	Solid inclusions in minerals.	Blue rock-salt (Na in NaCl).	Solid solutions.
s + L	Suspensions.	Suspensoids.	Solutions.
s + G	Dust, volcanic ashes.	Smoke.	—
l + S	Liquid inclusions in minerals.	Occluded liquids.	Water of crystallisation.
l + L	Emulsion.	Emulsoid.	Solutions.
l + G	Rain.	Fog.	—
g + S	Gas inclusions in minerals.	Occluded gases.	Adsorbed gases.
g + L	Foams.	Colloid foams.	Solutions.
g + G	—	—	Solutions.

H. E. Ashley : *U.S.G.S. Bull.* 388, 1909.
A. F. Rogers : *Journ. Geol.*, xxv, 1917, p. 515.
W. Ostwald (trans. by M. H. Fischer) : *Theoretical and Applied Colloid Chemistry*, 1917.
E. Hatschek : *Introduction to the Physics and Chemistry of Colloids*, 1918.

Colour Ratio, *Shand,* 1915.—The ratio of *felsic* (light) to *mafic* (dark and heavy) minerals in an igneous rock, which thus accurately expresses the leuco-, meso-, or melano-cratic character of the rock.

S. J. Shand : *Journ. Geol.,* xxiv, 1916, p. 403.

Columnar Structure.—A structure found in lava flows, sills, and dykes, and most characteristically developed in basaltic rocks, due to the regular development of prismatic joints that break up the rock into parallel columns, the sides of which average six in number. Analogous prismatic structures sometimes occur in rocks other than igneous.

T. G. Bonney : *Q.J.G.S.,* xxxii, 1876, p. 140.
E. M. Kindle : *Geol. Surv. Canada, Mus. Bull.* 2, 1914, p. 35.
R. B. Sosman : *Journ. Geol.,* xxiv, 1916, p. 215.
C. Dauzère : *C.R.* clxix, 1919, p. 76.

Comagmatic, *Washington,* 1906. — A term applied to igneous rocks (or to the district in which they occur) characterised by chemical and mineral peculiarities which point to consanguinity or community of origin. The term *Comagmatic Region* according to Washington is wider than *Petrographical Province* (Judd), since " province " implies that the area is part of a larger one, and " petrographical " does not include petrological characters and relations.

H. S. Washington : *Carnegie Inst. Wash., Pub.* 57, 1906, p. v.

Comendite, *Bertolio,* 1895.—An alkali-rhyolite containing soda-pyroxenes and/or soda-amphiboles. (Comende, Sardinia.)

G. T. Prior : *Min. Mag.,* xiii, 1902, p. 242.

Complementary Dykes, *Brögger,* 1894. — Associated dykes (or other minor intrusions) composed of different but related rocks regarded respectively as *leucocratic* and *melanocratic* differentiation products from a common magma (*e.g.*, aplites and lamprophyres ; bostonite and camptonite).

W. C. Brögger : *Q.J.G.S.,* l, 1894, p. 31.

Component.—In the phase rule this term denotes each of the integral parts (independent molecular species not connected by a chemical equation), of which a system is composed, and in terms of which the system may be described (*e.g.*, the system CaO, Al_2O_3, SiO_2).

Composite Dykes, *Judd,* 1893.—Dykes consisting of two or more injections of magmas having different compositions. The term *composite* is similarly applied to sills, laccoliths and other intrusions.

Mem. Geol. Surv. Scot., 53 (Ben Nevis and Glen Coe), 1916, p. 144.

A. Harker: *Mem. Geol. Surv. Scot.* (Tert. Ig. Rocks Skye), 1904, p. 197.

W. R. Smellie: *Trans. Geol. Soc. Glasgow,* 1913, p. 1.

Composite Gneiss.—Gneisses produced by the intimate association, with or without molecular intermixture, of two different materials, the one (generally a granitic magma) having been injected into the other (*e.g.*, along the parting planes of a schist).

G. A. J. Cole: *Proc. Roy. Irish Acad.*, xxiv, 1902, p. 263.

Concretions.—Nodular or irregular concentrations of certain authigenic constituents of sedimentary rocks and tuffs; developed by the localised deposition of material from solution, generally about a central nucleus; *e.g.*, septaria, flint, nodules of marcasite or iron-pyrites, löss püppchen, kankar, etc.

G. F. Becker: *U.S.G.S., Mon.,* xiii, 1888, p. 64.

R. Delkeschamp: *Zeit. f. Prakt. Geol.*, xii, 1904, p. 289.

W. A. Richardson: *Min. Mag.*, xviii, 1919, p. 327.

Cone-in-cone Structure.—A concretionary structure occurring in marls, ironstones, coals, etc., characterised by the development of a succession of cones one within another, due to radial crystallisation about a common axis.

G. A. J. Cole: *Min. Mag.*, x, 1892, p. 136.

Conglomerate.—A cemented clastic rock containing rounded fragments corresponding in their grade

sizes to gravel or pebbles. *Monogenetic* and *polygenetic* types are recognised, according to the uniformity or variability of the composition and source of the pebbles.

G. R. Mansfield: *Bull. Museum Comp. Zoology Harvard*, xlix, *Geol. Ser.*, viii, No. 4.
J. W. Gregory: *Geol. Mag.*, 1915, p. 447.
W. Deeke: *Ber. Naturfor. Gesell.*, xxii, (i), 1919.

Congressite, *Adams & Barlow*, 1913. — A hololeucocratic coarsely granular igneous rock composed mainly of nepheline, with small amounts of sodalite, plagioclase, micas, calcite, and titanoferrite. (Congress Bluff, Craigmont Hill, Ontario.)

F. D. Adams & A. E. Barlow: *Cong. Geol. Inter.*, xii, Guide 2, 1913, p. 96.

Connate, *Lane*, 1908.—A term applied to waters (and extended to include CO_2 in limestones, and other volatile materials) buried with exogenetic formations and volcanic rocks, and remaining stagnant except as they are liberated by diagenesis or metamorphism.

A. C. Lane: *Bull. Geol. Soc. Am.*, xix, 1908, p. 502.

Consanguinity, *Iddings*, 1892.—A term implying "blood relationship," or community of origin, in the rocks of a single volcanic or petrological district or province, and revealed by common peculiarities of mineral and chemical composition, and often also of texture. Cf. *Petrographical Province.*

J. P. Iddings: *Bull. Phil. Soc. Wash.*, xii, 1892, p. 89.

Consertal, *C.I.P.W.*, 1906.—A term applied to equigranular texture, when irregularly-shaped crystals closely interlock without interstitial spaces.

C.I.P.W.: *Journ. Geol.*, xiv, 1906, p. 703.

Contact (or Local) Metamorphism.—Metamorphism genetically connected with the intrusion (or extrusion) of magmas, *i.e.*, the alteration of rocks referred to their contact with or proximity to, a body of igneous rock. It is probable that in most cases of contact metamorphism the depth at which alteration took place was moderate, whereas in

regional metamorphism (also in part due to magmatic transfer of heat) the depth was greater. Cf. *exomorphic* and *endomorphic metamorphism*.

Mems. Geol. Surv. (Silurian Rocks, Britain), I, 1899, p. 634; (Ben Nevis and Glen Coe), 1916, p. 187; (North-West Highlands), 1907, p. 453.

J. M. Clements: *Am. Journ. Sci.*, vii, 1899, p. 81.

V. M. Goldschmidt: *Die Kontakt Metamorphose im Kristianiagebiet*, 1911.

Contemporaneous.—A term applied to interbedded volcanic rocks (contrasting them with sills of later date than the enclosing rocks); to segregation veins and patches (cf. *schlieren*) in bodies of igneous rocks; to dolomites produced from limestones soon after the deposition of the latter; and generally, to all rocks and facies developed while the processes of formation of the enclosing rocks were still in operation.

Convection. — The internal circulation within a fluid mass set up by differences of density in different parts of the mass owing to changes in temperature or phase. For the application to magmas, see—

F. F. Grout: *Journ. Geol.*, xxvi, 1918, p. 481.

C. H. Desch: *Journ. Inst. Metals*, xi, 1914, p. 77.

Coppaelite, *Sabatini*, 1903. — A porphyritic volcanic rock composed of phenocrysts of augite in a holocrystalline groundmass of pyroxene, melilite, phlogopite and small amounts of perovskite and apatite. (Coppaeli di Sotto, Umbria.)

Coprolite.—The fossilised excrement of fishes, reptiles and mammals. As these remains are largely composed of calcium phosphate, the term applied to them has been commercially extended to include phosphatic nodules.

Coquina.—A loosely cemented fragmental shelly limestone occurring in Florida.

Coral Mud and Sand.—Deposits formed around coral-islands and coasts bordered by coral-reefs, containing abundant fragments of corals. Near the reefs the grade sizes are relatively coarse, and the

deposit is described as *coral-sand*, whereas further out, the grades become gradually finer until the material is a *coral-mud*.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 244.

Cordierite-anthophyllite Rock, *Eskola*, 1914. — A pneumatolytic-metamorphic rock consisting essentially of anthophyllite (as radiating bunches or irregularly distributed prisms) and cordierite. Other minerals, such as biotite, garnet, quartz, plagioclase and magnetite, may be present in varying amounts, and by increase in plagioclase the type passes into plagioclase-gneiss.

P. Eskola : *Bull. Comm. Géol. Finlande*, 40, 1914, pp. 169, 187, 252.

Cordierite-norite, *Lacroix*, 1898.—A term applied to endomorphic varieties of norite containing cordierite. Cf. *Muscovadite*.

A. Lacroix : *Bull. Serv. Carte Geol. France*, No. 67, x, 1898-99.

W. R. Watt : *Q.J.G.S.*, lxx, 1914, p. 285.

For *Cordierite* in general, see

J. J. H. Teall : *Proc. Geol. Assoc.*, xvi, 1899, p. 62.

Cornstone.—A term applied to the concretionary and other limestone masses associated with the Old Red and the New Red Sandstone formations. Their presence increases the fertility of the soil derived from the formations in which they occur, and hence the name.

Cornubianite, *Boase*, 1832. — A term applied to finely granulose rocks of horny aspect (hornfels), formed by contact metamorphism, and consisting of micas, quartz, and felspar. Cf. *Leptynolite*.

(*Cornubia*=Cornwall.)

T. G. Bonney : *Q.J.G.S.*, xlii, 1886, p. 104.

W. Salomon : *Cong. Géol. Inter. C.R.*, viii (Paris, 1900), 1901, p. 343.

Corona (Coronite, *Brögger*).—A term applied to zones of radially-arranged minerals (*e.g.*, of pyroxene amphibole, garnet, etc.) that occur around olivine or hypersthene in certain gabbros, norites and re-

lated rocks. They may be metamorphic *reaction rims,* or due directly to the order of crystallisation, and thus of igneous origin. It has been suggested by Bonney that the term *Kelyphitic rim* be restricted to occurrences of secondary origin, leaving *Corona* for those that are primary.

Corrosion.—The modification of phenocrysts or xenoliths, etc., by the solvent action upon them of the residual magma in which they are contained. The same term (*corrasion* of some American authors) connotes the vertical excavation of the land by rivers and glaciers.

P. Eskola : *Bull. Comm. Géol. Finlande,* 40, 1914, p. 22.

Corsite, *Collomb,* 1853. — A well-known variety of orbicular diorite or hornblende-gabbro occurring in Corsica = *Napoleonite.*

Cortlandtite, *Williams,* 1886. — Hornblende-peridotite = *Hudsonite.* The type variety contains hornblende in large crystals, with poikilitically-included crystals of olivine.

(Cortlandt, New York.)

G. S. Rogers : *Ann. N. York Acad. Sci.,* xxi, 1911, p. 11.

Corundolite, *Wadsworth,* 1891. — A systematic term proposed for *emery-rock.*

Country Rock. — A general term for the rock surrounding and penetrated by mineral veins ; sometimes used in a wider sense for the rocks invaded by igneous intrusions.

Covite, *Washington,* 1900.—A somewhat melanocratic variety of nepheline-syenite, in composition falling between the latter and shonkinite.

(Magnet Cove, Arkansas.)

H. S. Washington : *Journ. Geol.,* ix, 1901, p. 612.

Craiglockhart Basalt, *Hatch,* 1892. — A type of the Scottish Carboniferous basalts ; characterised by the presence of conspicuous phenocrysts of olivine and augite in a fine-grained basaltic groundmass.

E. B. Bailey : *Mem. Geol. Surv. Scot.* (East Lothian), 1910, p. 118.

Craigmontite, *Adams & Barlow.* — A leucocratic facies of nepheline-syenite, containing in order of abundance, nepheline, oligoclase, and muscovite, with small amounts of calcite, corundum, biotite and magnetite. (Craigmont Hill, Ontario.)

F. D. Adams & A. E. Barlow: *Geol. Surv. Canada Mem.*, 6 (Pub. No. 1,082), 1910, p. 313.

Crinanite, *Flett,* 1911.—A variety of olivine-analcite-dolerite, containing purple augite, and characterised by well-developed ophitic texture. (Loch Crinan, Argyll.)

Mem. Geol. Surv. Scot. (Colonsay), 1911, p. 35.

Cromaltite, *Shand,* 1906. — An alkali pyroxenite, containing ægirine-augite, melanite and biotite. (Cromalt Hills, Assynt.)

S. J. Shand: *Trans. Edin. Geol. Soc.*, ix, 1910, p. 394.

Crush-breccia, *Bonney.*—A cataclastic breccia formed *in* or nearly *in situ* by mechanical fragmentation.

Crush-conglomerate, *Lamplugh,* 1895.—A cataclastic conglomerate formed by mechanical fragmentation and friction, due to earth-stresses.

G. W. Lamplugh: *Q.J.G.S.*, li, 1895, p. 563.

Cryptocrystalline (Microcryptocrystalline of some American authors).—A term implying that a rock or groundmass is composed of a crystalline aggregate that can only be recognised as such by its appearance in thin section between crossed nicols; individual minerals not being directly determinable.

Cryptographic, *Harker,* 1895.—A texture, often radial, due to the intergrowth of quartz and felspar on so fine a scale that the individual component minerals cannot be clearly resolved under the microscope; a cryptocrystalline granophyric texture.

Crystal.—A body, generally solid, but not necessarily so, whose component atoms are arranged in definite space lattices, crystal faces being a com-

monly developed outward expression of the periodic arrangement of atoms.

W. H. and W. L. Bragg: *X-Rays and Crystal Structure*, 1915.

F. E. Wright: *Journ. Wash. Acad. Sci.*, vi, 1916, p. 326.

Crystalline Limestone. — A general term for metamorphosed limestones, the mineral composition depending on the character of the original limestone, the thermo-dynamic conditions under which the metamorphism was effected, and the amount and composition of material (if any) introduced from external sources. See *calciphyre, cipolino, marble, ophicalcite, predazzite*, etc. A limestone recrystallised by diagenesis is described as *recrystallised.*

A. K. Coomáraswámy: *Q.J.G.S.*, li, 1902, p. 399; lix, 1903, p. 91.

J. J. H. Teall: *Mem. Geol. Surv.* (N.W. Highlands), 1907, p. 41.

A. S. Eakle: *Bull. Dept. Geol. Univ. California*, x, 1917, p. 327.

Crystalline Schist.—See **Schist.**

For References see under **Metamorphism.**

Crystallinity.—A term applied to the degree of crystallisation exhibited by an igneous rock; expressed by terms such as *holocrystalline, hypocrystalline, holohyaline*, etc.

Crystallisation. — The process whereby crystalline phases separate from a fluid, viscous, or dispersed state (gas, liquid solution, or rigid solution).

G. F. Becker & A. L. Day: *Journ. Geol.*, xxiv, 1916, p. 313.

F. E. Wright: *Journ. Wash. Acad. Sci.*, vi, 1916, p. 326.

Crystallite, *Vogelsang*, 1870. — A general term for minute bodies without reaction on polarised light, occurring in glassy igneous rocks: *e.g., globulite, longulite, margarite, trichite*, and other forms of incipient crystallisation that cannot be referred to definite mineral species.

F. Rutley: *Min. Mag.*, ix, 1891, p. 261.

C. H. Desch: *Journ. Inst. Metals*, xi, 1914, p. 65.

Crystalloblastic, *Becke*, 1903.—A term applied to the textures of metamorphic rocks due to recrystallisation under conditions of high viscosity and directed pressure, in order to distinguish them from the textures of igneous rocks, which are due to the successive crystallisation of minerals under conditions of relatively low viscosity and nearly uniform pressure.

F. Becke: *Cong. Géol. Inter. C.R.*, ix, 1903, p. 553.
U. Grubenmann: *Die Kristallinen Schiefer*, I, 1904.
F. L. Stillwell: *Aust. Ant. Exped. Sci. Rept. A*, iii, I (1) (Met. Rocks, Adelie Land), 1918, p. 40.

Crystal Tuffs, *Cohen*, 1871. — Volcanic tuffs, which are largely composed of crystal fragments. Cf. *vitric* and *lithic* tuffs.

L. V. Pirsson: *Am. Journ. Sci.*, xl, 1915, p. 191.

Cucalite, *Rolle*, 1879. — A variety of diabase characterised by abundant chlorite and passing locally into chlorite-schist. (Rhætic Alps.)

Culm.—A vernacular term variously applied according to the locality, to carbonaceous shale, or to fissile varieties of anthracitic coal. The term has also a definite stratigraphical meaning for beds of Pendleside and Westphalian age.

Cumberlandite, *Wadsworth*, 1884. — A phanerocrystalline rock composed of ferriferous olivine, ilmenite and magnetite, with small amounts of labradorite and spinel.

(Iron Mine Hill, Cumberland, Rhode I.)

Cumbraite, *Tyrrell*, 1917. — A porphyritic rock, containing phenocrysts of bytownite-anorthite in a groundmass of labradorite, enstatite-augite and abundant glass; and in chemical composition corresponding to andesite rather than to basalt.

(Great Cumbrae, Firth of Clyde.)

G. W. Tyrrell: *Geol. Mag.*, 1917, p. 306.

Cumulite, *Vogelsang*, 1872.—A term applied to cloudy aggregates of globulites occurring in vitreous rocks.

F. Rutley: *Min. Mag.*, ix, 1891, p. 261.

Cumulophyric, *C.I.P.W.*, 1906. — A term applied to glomeroporphyritic texture in the widest sense, *i.e.*, when the clusters of crystals forming composite phenocrysts are not necessarily aggregates of the same mineral.

C.I.P.W.: *Journ. Geol.*, xiv, 1906, p. 703.

Cumulose Deposits, *Merrill*, 1897. — Sedentary accumulations of carbonaceous matter, with very little detrital sediment, *e.g.*, *peat, swamp-soil.*

Cup-and-ball Structure.—A cross jointing of columnar igneous rocks, in which one face of the joint is concave and the other convex; as in the columns of the Giant's Causeway.

Cupola, *Daly*, 1911.—A dome- or boss-like protrusion from the body of a batholith, forming a conspicuous irregularity in its roof.

Current- or Cross-bedding. — A structure of sedimentary rocks, generally arenaceous, in which the planes of deposition, as shown by the arrangement of the grains in successive layers, lie obliquely to the planes separating the larger units of stratification. The structure is commonly developed in æolian, deltaic and torrential deposits, each of which has its own distinctive characters.

Cuselite, *Rosenbusch*, 1887.—A term applied to leucocratic varieties of biotite-augite-porphyrite containing abundant phenocrysts of andesine and few of the mafic minerals, in a felspathic groundmass. (Cusel, Saar Basin.)

D

Dacite.—Quartz-andesite. According to the composition of the plagioclase, three different types of dacite are distinguished by Iddings: *Ungaite* (oligoclase), *Shastaite* (andesine), and *Bandaite* (labradorite). The last of these would generally be regarded as a variety of quartz-basalt.

H. H. Robinson: *U.S.G.S., Prof. Pap.*, 76, 1913, p. 114.

Dacitoid, *Lacroix*, 1919.—A volcanic rock having the chemical composition of dacite but free from modal quartz.

A. Lacroix : *C.R.*, xlxviii, 1919, p. 297.

Dactylitic, *Sederholm*, 1916.—A textural term applied to finger-like projections from a continuous crystal, the fingers (*e.g.*, of biotite) and the intercalated mineral between them (*e.g.*, of quartz) together forming a *symplektite*, q.v.

J. J. Sederholm : *Bull. Comm. Géol. Finlande*, No. 48, 1916, Figs. 32-4, Pl. vi.

Dactylotype, *Shand*, 1906.—A textural term applied to the intergrowth of sodalite with orthoclase in borolanite and its associates ; the sodalite has been altered to pinitic mica and appears in thread-like or vermicular aggregates closely packed in a matrix of orthoclase.

S. J. Shand : *Trans. Edin. Geol. Soc.*, ix, 1910, p. 387, Pl. 39.

Dahamite, *Pelikan*, 1902. — A variety of paisanite characterised by the presence of abundant albite.

(Dahamis, Socotra.)

Dalmeny Basalt, *Hatch*, 1892.—A type of the Scottish Carboniferous basalts ; characterised by the abundance of microphenocrysts of olivine, augite and plagioclase being restricted almost always to the groundmass.

J. D. Falconer : *Trans. Roy. Soc. Edin.*, xlv, 1906, p. 133.

Damouritisation, *Lacroix*, 1896.—The process whereby the aluminous silicates (felspars, etc.), of a rock are transformed into damourite (a variety of muscovite).

A. Lacroix : *Min. de la France*, ii, 1896, p. 41.

Davainite, *Wyllie & Scott*, 1913.—A rock consisting essentially of brown hornblende which is paramorphic after pyroxene, the amount of other minerals, such as felspar, being small.

(Garabal Hill.)

B. K. N. Wyllie & A. Scott : *Geol. Mag.*, 1913, p. 499.

Dedolomitisation, *Teall.* — A process whereby a dolomite, during metamorphism, loses its content of magnesium carbonate, the magnesium remaining as oxide or hydroxide (*e.g.*, in *pencatite*) or as a silicate (*e.g.*, in *forsterite marble, ophicalcite,* etc.). It is not desirable to extend the term, as has recently been suggested, to include the removal of dolomite mechanically.

J. J. H. Teall: *Geol. Mag.*, 1903, p. 513.
A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks Skye), 1904, p. 144.
J. J. H. Teall: *Mem. Geol. Surv. Scot.* (N.W. Highlands), 1907, p. 453.
F. H. Hatch & R. H. Rastall: *Q.J.G.S.*, lxvi, 1910, p. 507.
T. Crook: *Geol. Mag.*, 1914, p. 339.

Degrees of Freedom.—The number of physical conditions, including temperature, pressure, and concentration, that can be varied independently in a system without destroying a *phase.*

Dellenite, *Brögger,* 1896. — A volcanic rock intermediate between rhyolite and dacite, *i.e.*, containing both orthoclase and oligoclase-andesine; = *quartz-latite* = *quartz-trachyandesite.*

(Lake Dellen, Sweden.)

Density.—The density of a substance is the weight (expressed in grams) of unit volume (one cubic centimetre) of the substance at 4° C. Cf. *Specific Gravity.*

A. L. Day *et aliter*: *Am. J. Sci.*, xxxvii, 1914, p. 1.
A. Holmes: *Petrographic Methods and Calculations*, 1920.

Denudation, *Poullet-Scrope,* 1825. — The sum of the processes that result in the wearing down of the surface of the earth. The term is wider in its scope than *erosion,* the restriction proposed by Lyell (limiting it to the action of running water) not having been generally adopted.

J. W. Gregory: *Geog. Journ.*, xxxvii, 1911, p. 189.
J. W. Evans: *Proc. Geol. Assoc.*, xxiv, 1913, p. 241; xxv, 1914, p. 229.

Derivate, *Forbes*, 1867.—A general term for "sedimentary" rocks derived from the products of destruction of primary rocks. Cf. *Ingenite.*

Dermolith, *Jaggar*, 1917. — A term, meaning "skinstone," applied to ropy-lava or *pahoehoe*-lava.

T. A. Jaggar: *Jour. Wash. Acad. Sci.*, vii, 1917.

Desmosite, *Zincken*, 1841.—A contact metamorphosed shale or slate differing from *spilosite* by having a banded structure.

Detritus. — Fragmental (*epiclastic*) material, such as sand and mud, derived from older rocks by disintegration. The deposits produced by the accumulation of detritus constitute the detrital sediments.

Deuteric, *Sederholm*, 1916.—A term applied to alterations in an igneous rock produced during the later stages, and as a direct consequence, of the consolidation of the magma of the rock. (Cf. *Paulopost.*) The term discriminates such alterations from the more strictly *secondary* changes due to a later period of alteration.

J. J. Sederholm: *Bull. Comm. Géol. Finlande*, No. 48, 1916, p. 142.

Deuterogenous, *Naumann*, 1858.—A group name for "derived" rocks; used more definitely by *Renevier*, 1880, for sedimentary rocks of mechanical origin.

Deuteromorphic, *Lœwinson-Lessing*, 1897.—A general term applied to crystals to indicate that their shapes have been acquired or modified by the action of mechanical or chemical processes on the forms which they originally possessed. Deuteromorphic forms are described as *tectomorphic* when the modifications are due to magmatic corrosion; as *lytomorphic*, when due to aqueous solutions; as *schizomorphic*, when due to cataclastic processes; as *clastomorphic*, when due to denudation as in the rounded or angular grains of a detrital sediment; and as *neomorphic* when any one of the preceding

types has been regenerated by zones of secondary growth in crystalline continuity.

Devitrification.—The process by which glass (natural or artificial) develops a minutely crystalline or lithoidal texture, and becomes microfelsitic or microspherulitic. Devitrification is an expression of solid diffusion, promoted by crystal forces so long as the latter are not inhibited by internal friction.

T. G. Bonney & J. Parkinson : *Q.J.G.S.*, ix, 1903, p. 429.
N. L. Bowen : *Journ. Am. Ceramic Soc.*, ii, 1919, p. 261.

Devonite, *Johannsen,* 1910.—A variety of porphyritic dolerite characterised by phenocrysts of plagioclase rich in potassium. (Mt. Devon, Mass.)

Diabase, *Brongniart,* 1807.—This term originally denoted rocks that were later recognised by Haüy as diorites. (Conversely, in many of the older geological maps of Ireland, rocks are named *diorite* that would now be called *diabase.*) For a time the term *diabase* was applied to pre-Tertiary dolerites, and since, especially in Britain, such rocks are frequently altered, the term has come to mean an altered dolerite in which the felspars are saussuritised or albitised, or the pyroxenes more or less replaced by hornblende or chlorite. German and most American authors, however (following Rosenbusch), use *diabase* in a sense synonymous with the British usage of *dolerite.*

Diablastic, *Becke,* 1903.—See **Sieve Texture.**

Diagenesis, *Gumbel,* 1888.—A term denoting the sum of the successive changes which take place in exogenetic rocks as a result of continued sedimentation above them, or of the percolation of ground-waters through them; *e.g.,* consolidation, development of lamination by increase of vertical pressure due to the superincumbent load, and cementation and recrystallisation due to seasonal

and other regular changes in water content and temperature of a normal exogenetic character.

E. Andrée : *Geol. Rund.*, iii, 1912, p. 324.
W. Deeke : *Ber. Naturfor. Gesell.*, xxii, (i), 1919.

Diallagite, *Des Cloizeaux*, 1863. — A rock composed almost wholly of diallage. Small amounts of other pyroxenes, hornblende, pleonaste, or garnet may be present.

Diamagnetism, *Faraday*, 1845.—A property of certain substances — essentially different from ferromagnetism and paramagnetism—in virtue of which, when placed in a non-uniform magnetic field, they tend to move towards the weakest part. Unlike ordinary magnetic bodies the molecule has either no inherent polarity or has a balanced polarity. In a magnetic field the induced polarity leads to repulsion, and diamagnetic susceptibility is therefore negative. Cf. *Paramagnetism.*

T. Crook : *Science Progress*, No. 5, 1907, p. 30.

Diaschistic, *Brögger*, 1896.—A term applied to those rocks of minor intrusions which appear to be respectively melanocratic or leucocratic differentiates from a common magmatic source.

Diatomite, Diatomaceous Earth. — A pulverulent siliceous deposit formed by the accumulation of the frustules of diatoms in lakes or swamps ; = *Tripoli* = *Kieselguhr.*

Diatom Ooze, *Murray*, 1873.—A deep-sea deposit, resembling flour when dry, largely composed of the frustules of diatoms, and containing a small but variable proportion of calcareous organisms and mineral particles.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 208.

Diatreme. — A general term for volcanic pipes and vents drilled through the enclosing rocks by the explosive energy of gas-charged magmas.

W. Branca : *Schwaben* 125 *Vulcanembryonen*, Stuttgart, 1894.

Differential Pressure.—See **Directed Pressure.**
J. Johnston & P. Niggli : *Journ. Geol.*, xxi, 1913, p. 614.

Differentiated (*Sill, Dyke, Laccolith, Batholith, etc.*). —A term applied to major and minor intrusions that are built up of two or more rock-types that have developed *in situ* by differentiation from a common magna.
R. A. Daly : *Igneous Rocks and their Origin*, 1914, p. 229, and Table xiv, p. 230.

Differentiation. — A general term for the processes whereby different types of igneous rocks, which may or may not form parts of the same mass, are produced from a common magmatic source; the processes involved may be molecular, or the separation of immiscible liquids, or the separation of residual liquids from crystals already formed; and the interactions between units of differentiation formed at one time or place with those formed at other times or places must also be considered, and especially in relation to thermo-dynamic conditions and the presence of volatile fluxes.
W. C. Brögger : *Eruptivgest. Kristiania*, iii, 1898, p. 334.
See also S. J. Shand : *An Introduction to Petrology, etc.* (Royal Scottish Museum, Edinburgh), 1909, p. 43, for a summary account of Brögger's work and its results.
H. S. Washington : *Journ. Geol.*, ix, 1901, p. 645.
A. Harker : *Nat. Hist. Ig. Rocks*, 1909, p. 309.
Cong. Géol. Inter. C.R., xii (1912), 1913, p. 189.
H. S. Jevons : *Journ. Roy. Soc. N.S.W.*, xlvi, 1913, p. 112.
N. L. Bowen : *Am. Journ. Sci.*, xxxix, 1915, p. 175; xl, 1915, p. 161.
—— *Journ. Geol.*, Supplement to xxiii, 1915, p. 3.
A. Holmes : *Q.J.G.S.*, lxxii, 1917, p. 271.
R. A. Daly : *Journ. Geol.*, xxvi, 1918, p. 115.
F. F. Grout : *Journ. Geol.*, xxvi, 1918, p. 626.
H. H. Read : *Geol. Mag.*, 1919, p. 368; 1920, p. 86.
N. L. Bowen : *Journ. Geol.*, xxvii, 1919, p. 393.

Diffusion.—The permeation of one substance through another; such as gas through gas, liquid or solid; solute through solvent, liquid through liquid or solid, and finally solid through solid. The pres-

sure corresponding to that exerted by dissolved material in its diffusion from a more concentrated to a less concentrated part of a solution is called *Osmotic pressure.*

R. E. Liesegang: *Geologische Diffusionen,* 1913.
C. H. Desch: *Rep. Brit. Assoc.* (Dundee, 1912), 1913, p. 348.
C. E. Van Orstand & F. P. Dewey: *U.S.G.S., Prof. Pap.,* 95, 1915, p. 83.

Diluvium.—An old term by which the older Quarternary or *Pleistocene* deposits were described in contradistinction to the younger Quarternary or *Recent* deposits laid down by rivers (alluvium). The term *diluvium* refers to the Deluge of Noah to the action of which the deposits were originally supposed to be due.

Diogenite, *Tschermak,* 1883. — An achondritic meteorite composed essentially of bronzite with small amounts of oligoclase; — *oligoclase chladnite.*

Diorite, *D'Aubuisson,* 1819. — A phanerocrystalline igneous rock composed of plagioclase (averaging andesine, or occasionally oligoclase) and mafic minerals such as hornblende, biotite, and augite, hornblende being especially characteristic. If quartz be present the term *quartz-diorite* is used. The term *diorite* means "a clear distinction" as opposed to *dolerite*, which means "deceptive." In Ireland many altered rocks, such as diabase and epidiorite, have been described as *diorite* on the older maps. Cf. *Laugenite.*

Dipyrisation, *Lacroix,* 1896, = **Scapolitisation.**—The process, sometimes involving pneumatolytic or allied agencies, whereby the felspathic constituents of a rock are replaced by dipyre or scapolite.

N. Sundius: *Geologie des Kirunagebietes,* Upsala, 1915, p. 195.
A. Lacroix: *Bull. Soc. franç. Min.,* 1916, p. 74.

Directed Pressure, *Evans,* 1919. — A term suggested in place of the terms "unequal," "non-uniform"

or "differential" pressure to denote the maximum stress-difference acting on any system, and which, unlike hydrostatic or "uniform" pressure operates in a definite direction. Thus a compression, and in general any natural pressure is resolvable into hydrostatic pressure, and directed pressure. The latter can have little effect on the properties of liquids beyond causing them to flow; but acting on solids, it modifies old structures and tends to the production of new ones, ranging in the case of rocks from mountain building to microscopic granulation, and leading finally to recrystallisation. During dynamic metamorphism the behaviour of crystalline bodies is controlled by both the hydrostatic and directed components of pressure whereas fluid phases are subject to the action of the former component only. Under these conditions the melting or volatilisation points of solids are lowered, locally and momentarily, and thus recrystallisation and diffusion are promoted. The study of dynamic metamorphism is essentially the study of the modifications effected in rocks by directed pressure.

J. Johnston & P. Niggli: *Journ. Geol.*, xxi, 1913, p. 599.
J. Johnston: *Journ. Geol.*, xxiii, 1915, p. 732.
A. Harker: *Q.J.G.S.*, lxxiv, 1918, p. lxxvii.
J. W. Evans: *Nature*, civ, Oct. 2nd, 1919, p. 106.

Ditroite, *Zirkel*, 1866.—A variety of nepheline-syenite containing sodalite among the felsic constituents, and biotite and ægirine-augite among the mafic minerals, with zircon and perovskite as noteworthy accessories. By *Brögger*, the term has been adopted to include all nepheline-syenites of granular texture, as opposed to those of trachytoid texture (*foyaite*). (Ditro, Transylvania.)

Do-, *C.I.P.W.*, 1902. — A prefix indicating that one factor *do*minates over another within the ratios 7/1 and 5/3 (7 and 1.67); *e.g.*, *docalcic, dofemic, dosalic*, etc.

Dolerine, *Jurine.*—A variety of talc-schist containing felspar and chlorite as the chief varietal minerals. (Pennine Alps.)

Dolerite, *Haüy.*—An igneous rock occurring as minor intrusions, consisting essentially of plagioclase (not less calcic than labradorite), and pyroxene. Olivine-bearing types are distinguished as *olivine-dolerite.* In a general way dolerite is distinguished from basalt by its coarser grain and the absence of glass; specifically, according to the definition of the *Comité française de Pétrographie*, 1900, by its holocrystalline character and the development of ophitic texture. In practice, however, there are many cases in which it is difficult, if not impossible, to make an unequivocal choice between the terms *basalt* and *dolerite,* since there is not, and cannot be, any definable line drawn between them. As field-terms, however, these names are generally restricted to extrusive and intrusive rocks respectively. Many Continental and American authors use the term *diabase* in a sense synonymous with *dolerite;* whereas in Britain only altered dolerites are denoted by the term *diabase.*

S. Allport: *Q.J.G.S.*, xxx, 1874, p. 529.
J. J. H. Teall: *Q.J.G.S.*, xl, 1884, p. 640.
A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks Skye), 1904, p. 315.

Dolomite, *de Saussure,* 1796.—A carbonate rock, consisting predominantly of the mineral dolomite.

Mem. Geol. Surv. Spec. Rep. Mineral Resources, vi, 1918, p. 190.

Dolomite-marble. — A variety of marble composed largely of dolomite, due to the metamorphism of dolomite-rock under physical conditions involving sufficiently high pressure to inhibit the dissociation of the compound $CaMg(CO_3)_2$.

F. H. Hatch & R. H. Rastall: *Q.J.G.S.*, lxvi, 1910, p. 507.

Dolomitic Limestone.—A limestone containing dolomite, but in which $CaCO_3$ is dominant over $MgCO_3$. Cf. *Magnesian Limestone.*

Dolomitisation. — A general term for the processes whereby dolomite takes the place of $CaCO_3$ in limestones, the latter thus becoming *dolomitic limestones,* or *dolomites.* The processes are described as *contemporaneous* when they take place shortly after the deposition of the limestone concerned, and as *subsequent* when they occur during some period later than that during which the limestones were deposited.

Report of the Coral Reef Committee of the Royal Society, 1904.

E. Steidtmann: *Journ. Geol.*, xix, 1911, pp. 223, 392.

R. C. Wallace: *Cong. Geol. Inter., C.R.*, xii (1913), 1914, p. 875.

F. M. Van Tuyl: *Geol. Surv. Iowa, U.S.A.*, vol. xxv, 1916, p. 364.

L. M. Parsons: *Geol. Mag.*, 1918, p. 246.

Dome.—This term is used not only to connote certain crystallographic, structural, and geographical phenomena, but also to describe at least two different types of modes of occurrence of igneous rocks:—It is applied (*a*) to stocks whose sides slope away quaquaversally at low and gradually increasing angles beneath the invaded formations; and (*b*) to rounded extrusions of highly viscous lava squeezed out from a volcano, and congealed above and around the orifice instead of flowing away in streams. Portions of older lavas or ejectamenta may be elevated by the pressure of the new lava rising from beneath. The second type of dome is usually distinguished as a *volcanic dome.*

A. Lacroix: *La montagne Pelée et ses éruptions,* 1906, p. 110; *La montagne Pelée après ses éruptions,* 1908, p. 31.

S. Powers: *Am. Journ. Sci.*, xlii, 1916, p. 261.

Domite, *von Buch.*—A general term for the hornblende- and biotite-trachytes of the Puy de Dôme. Many

of these are oligoclase-bearing, and the term has therefore come to be applied more specifically to oligoclase-trachytes or trachyandesites.

A. Lacroix: *C.R.*, cxlvii, 1908, p. 830.

Drachenfels Trachyte.—A type of trachyte containing phenocrysts of sanidine and oligoclase in a groundmass of lath-shaped microlites of orthoclase with sparing biotite, hornblende, and magnetite.

Dreikanter.—A term applied to the three-edged faceted pebbles formed by wind action in a dry climate, whether hot (desert) or cold (glacial).

F. A. Bather: *Proc. Geol. Assoc.*, xvi, 1900, p. 396.
A. Wade: *Geol. Mag.*, 1910, p. 394.
J. W. Evans: *Geol. Mag.*, 1911, p. 334.
J. W. Jackson: *Mem. and Proc. Manchester Lit. and Phil Soc.*, 1918, lxii, No. 9.

Druse. — A cavity whose walls are encrusted with crystals of the same minerals as those of the enclosing rock. To such cavities and the rocks containing them the term *drusy* is applied. Cf. *miarolitic*. Distinguished from *geode* by the fact that the latter can be separated as a hollow nodular secretion consisting generally of minerals different from those of the rock in which it occurs.

Dumalite, *Lœwinson-Lessing*, 1905. — A variety of trachyandesite. (Caucasus.)

Dungannonite, *Adams & Barlow*, 1909.—A granitoid igneous rock containing, in order of abundance, andesine, corundum, scapolite, micas, and sometimes a little nepheline.

(Dungannon, Renfrew Co., Ontario.)

F. D. Adams & A. E. Barlow: *Geol. Surv. Canada, Mem.* 6 (Pub. No. 1082), 1910, p. 322.

Dunite, *von Hochstetter*, 1864.—A peridotite consisting essentially of olivine, and often containing chromite.

J. M. Bell: *Geol. Surv. New Zealand, Bull.* 12, 1911, p. 31.

Dunsapie Basalt, *Bailey*, 1910.—A type of the Scottish Carboniferous basalts; characterised by the presence of numerous phenocrysts of plagioclase,

augite, and olivine, in a normal basaltic groundmass. Cf. *Lion's Haunch Basalt.*

E. B. Bailey : *Mem. Geol. Surv. Scot.* (East Lothian), 1910, p. 119.

G. W. Tyrrell : *Trans. Geol. Soc. Glasgow*, xiv, 1912, p. 245.

Dunstone.—(a) A local name for amygdaloidal spilite or diabase in the neighbourhood of Plymouth.

R. H. Worth : *Trans. Devon Assoc.*, xlviii, 1916, p. 217.

(b) A local name for certain varieties of magnesian limestone in the neighbourhood of Matlock.

Durain, *Stopes*, 1919.—A term suggested for the dull, hard ingredient of bituminous coal, which occurs in bands or lenticles of variable thickness having a close, firm, granular texture, generally flecked with hair-like streaks of bright coal. Under the microscope durain shows amber- to red-tinted spores embedded in a dark-grey, nearly opaque granular matrix.

Marie C. Stopes : *Proc. Roy. Soc. B.*, xc, 1919, p. 474.

Durbachite, *Sauer.*—A melanocratic biotite-syenite. (Durbach, Schwarzwald.)

Dyke.—An injected wall-like intrusion, cutting across the bedding or other parallel structures of the invaded formations, and having a thickness narrow in proportion to its length.

Dynamic Metamorphism.—The sum of the processes, controlled by orogenic movement and differential stresses, which were sufficiently powerful under the conditions of temperature at which the changes took place, to impress a totally new specific character on the rocks affected; involving marked structural changes due to crushing and shearing at low temperatures, and extensive recrystallisation at higher temperatures. The noteworthy features by which dynamic metamorphism is recognised become less distinctive at still higher temperatures, until, when conditions of extensive fusion are approached, at which point directed pressure be-

comes ineffective, they gradually die away. Cf. *Piezocrystallisation.*

P. Quensel: *Bull. Geol. Inst. Upsala*, xv, 1916, p. 91.
R. A. Daly: *Bull. Geol. Soc. Am.*, 28, 1917, p. 395.
J. J. H. Teall: *Proc. Geol. Assoc.*, xxix, 1918, p. 1.

E

Eclogite, *Haüy.*—A granulose rock formed of garnet, pyroxene (omphacite) and sometimes amphibole (smaragdite), with accessories such as sphene and zoisite; probably derived from gabbros, or rocks of corresponding composition, by high temperature metamorphism under conditions of high pressure and differential stress, or from magmas of corresponding composition by piezocrystallisation.

T. G. Bonney: *Min. Mag.*, vii, 1886, p. 1.

Edolite, *Salomon*, 1898. — A variety of *hornfels* consisting essentially of felspar and mica. Cordierite- and andalusite-edolites are recognised. Cf. *Aviolite* and *Astite.* (Edelo, Italian Alps.)

Effusive.—A term applied to igneous rocks poured out of a vent or fissure, as distinct from those *ejected* or *injected.*

Ehrwaldite, *Pichler*, 1875.—A variety of augitite containing both rhombic and monoclinic pyroxenes. (Ehrwald.)

Ejectamenta.—A general term for pyroclastic materials ejected from a volcanic vent; classified by Johnstone-Lavis as *essential* when they consist of material directly derived from the magma of the eruption; *accessory* when they consist of re-ejected portions of the volcanic cone; and *accidental* when they consist of older rocks underlying the volcano.

H. J. Johnston-Lavis: *Proc. Geol. Assoc.*, ix, 1886, p. 421.

Ejected Blocks.—A term applied to the larger fragments of a volcanic breccia, generally derived from

the internal or subjacent rocks of a volcano, and often highly metamorphosed.

H. J. Johnston-Lavis: *Trans. Edin. Geol. Soc.*, vi, 1893, p. 314.

Ekerite, *Brögger*, 1906.—An arfvedsonite-granite comparatively poor in quartz, containing soda-microcline and microperthite, with arfvedsonite and ægirine. The rock is normally equigranular, but passes marginally into *ekerite-porphyry*.

(Eker, Christiania district.)

Elaterite.—A variety of bitumen which, when fresh, is characterised by being elastic, but which, on exposure, becomes hard and brittle.

Elæolite-syenite, *Blum*, 1861.—A synonym for *Nepheline-syenite*, now falling into disuse, except in so far as it is restricted to comparatively coarsely-grained types which contain the massive variety of nepheline distinguished, on account of its greasy lustre, as elæolite.

Elasticity of Bulk. — The property possessed by all substances whereby they tend to recover their original volume after being compressed or extended.

Elasticity of Form (Rigidity). — The property possessed by solid bodies whereby they tend to recover their original form after being distorted. A perfectly rigid body is one which cannot be deformed by any stress whatever.

Electrostatic Separation.—The separation of minerals according to their electrical conductivity, good conductors, such as ilmenite, being attracted by a charged body, while bad conductors such as quartz are unaffected.

T. Crook: *Min. Mag.*, xv, 1909, p. 260; xvi, 1911, p. 109.

Ellipsoidal.—A structural term applied to spilitic and similar rocks which, as a result of the conditions under which they consolidated, are disposed in a series of sack- or pillow-like masses. = *Pillow Structure*.

J. V. Lewis: *Bull. Geol. Soc. Am.*, xxv, 1914, p. 595.

Elutriation.—The process whereby sand or other loose detritus is separated into grades by currents of water of known and controlled velocity. Using upward-moving currents of water at 15° C. a velocity of 6.7 m.m. per second suffices to separate silt from sand, and one of 0.12 m.m. per second, mud from silt.

T. Crook: In *Sedimentary Rocks* (Hatch & Rastall), London, 1913, p. 349.

P. G. H. Boswell: *British Resources of Refractory Sands*, London, 1918, p. 20.

Eluvium.—A general term, used more particularly by Continental and American writers, for residual deposits.

Elvan. — A Cornish name (*el* = rock; *van* = white, Keltic) sometimes systematised as *elvanite*, for quartz-porphyry and other dyke rocks of similar composition. The term *Blue Elvan* is applied to greenstone-dykes.

Emery-rock.—A granulose rock consisting essentially of corundum and iron-ores, which may be formed by magmatic segregation or by the metamorphism of *laterite*. The term *emery*, alone, connotes the commercial product obtained by crushing the rock.

G. S. Rogers: *Ann. New York Acad. Sci.*, xxi, 1911, p. 66.

H. Müller: *Zeit. f. Prakt. Geol.*, xxiv, 1916, p. 11.

Enantiotropic.—A term applied to the transition of one polymorphic form of a substance to another (*e.g.*, quartz⟺tridymite) when the change can take place in either direction according to the conditions.

Enclaves, *Lacroix*, 1893. — A general term for enclosures or inclusions of any kind contained in igneous rocks. The types recognised by Lacroix are set forth in the following four paragraphs.

A. Lacroix: *Les Enclaves des Roches volcaniques*, Paris, 1893, p. 8; *La Montagne Pelée et ses Eruptions*, 1904, p. 537.

Enclaves Enallogènes. — Xenoliths or accidental inclusions.

Enclaves Homœogènes. — Autoliths or cognate inclusions formed from the same magma as the enclosing rock. They are respectively described as (*a*) *synmorphes* (synmorphous), when they have the same textures as the enclosing rocks; (*b*) *plésiomorphes*, when they have similar but not identical textures; and (*c*) *allomorphes*, when the textures are notably different from those of the enclosing rocks. These types in turn may be *homologues*, when the composition of enclave and enclosing rock is the same, or *antilogues*, when the compositions are different, that of the enclave being always the more basic.

Enclaves Pneumatogènes. — Enclaves formed at great depths by the action of the volatile fluxes of the magma.

A. Lacroix: *Bull. Soc. franç. Min.*, xxiv, 1901, p. 488.

Enclaves Polygènes.—Enclaves formed by the action of the magma or its volatile fluxes on another type of enclave.

Enclosures. — A term applied to allothigenous fragments of rocks or minerals included in igneous rocks; generally referred to as *inclusions*.

S. Powers: *Journ. Geol.*, xxiii, 1915, pp. 1 and 166.

Endogenetic.—A term applied to geological processes originating within the earth, and to rocks, ore-deposits, and land-forms which owe their origin to such processes. Contrasted with *Exogenetic*.

T. Crook: *Min. Mag.*, xvii, 1914, p. 72.

Endogenous Enclosures.— = Cognate Inclusions.

Endomorphism, *Fournet*, 1867. — The modification produced in an igneous rock due to the partial or complete absorption (assimilation) of portions of the rocks invaded by its magma; a phase of contact-metamorphism in which attention is directed to the changes suffered by the intrusion instead of to those produced in the invaded formations.

Enrichment. — The sum of the secondary processes whereby one part of an ore-deposit is enriched at the expense of the parts above.

W. H. Emmons: *U.S.G.S. Bull.*, 625, 1917.

Eo-, *Nordenskiöld*, 1893. — A prefix indicating the alteration of volcanic rocks by devitrification or recrystallisation; *e.g.*, *Eorhylite, eoandesite*, etc. Cf. *Apo-*.

O. Nordenskiöld: *Bull. Geol. Inst. Upsala*, i, 1893, p. 153.

Eozoon. — The generic name of a supposed foraminiferal fossil occurring in the Grenville Limestone; now known to be an inorganic aggregate of pairs of minerals such as calcite and serpentine.

H. J. Johnson-Lavis & J. W. Gregory: *Sci. Trans. Roy. Dublin Soc.*, v, 1894, p. 259.

Epi-, *Gümbel*, 1888. — A prefix, indicating alteration, properly used as a qualifier to the names of rocks which have suffered a change in mineral composition, but wrongly used in *epidiorite*, where it is added to the name of a rock (diorite) analogous in mineral composition to that of another rock (dolerite) as modified by alteration. The following terms are thus *synonymous* or nearly so—*epidiorite* (Gümbel), *epidiabase* (Issel), *epidolerite*, and *apodolerite* (Van Hise).

Epi-, *Grubenmann*, 1907.—A prefix used as a qualifier to the group-names suggested by Grubenmann for metamorphic rocks, to indicate that the type so distinguished belongs to the "upper zone" of metamorphism. In this zone the distinctive physical conditions are moderate temperature, lower hydrostatic pressure and powerful stress, and the rocks characteristically produced include mylonites, and cataclastic rocks generally, phyllites, chlorite-schists, talc-schists, porphyroids, and in part marbles and quartzites. Cf. *Meso-* and *Kata-*.

U. Grubenmann: *Die Kristallinen Schifer*, II, 1907, pp. 21, 172.

Epiclastic. *Teall*, 1887. — A term applied to clastic rocks formed by exogenetic processes, *i.e.*, to detrital sediments formed at the surface of the earth.

Epidiabase. *Issel*, 1892.—A term proposed in place of *epidiorite* in order to avoid confusion with the term *diorite*. British writers, however, have continued to use the older term, defined below.

Epidiorite. *Gumbel*, 1874.—A doleritic or basaltic rock in which the augite has suffered alteration to hornblende, so that the rock approaches the composition of a diorite. Distinguished from *diabase* by the less extreme alteration of the felspars.

J. S. Flett: *Mem. Geol. Surv.*, 359 (Lizard), 1912, p. 102.

Epidosite. *Reichenbach*, 1834. — A term applied to altered igneous rocks, or veins traversing them, essentially containing epidote and quartz, and generally other secondary minerals such as uralite and chlorite.

J. S. Flett: *Mem. Geol. Surv.* (Lizard), 1912, p. 50.
F. L. Stillwell: *Aust. Ant. Exp. Sci. Rep. A*, iii I (1) (Met. Rocks, Adelie Land), 1918, p. 58.

Epigene. *A. Geikie*, 1879.—A general term for geological processes originating at or near the surface of the earth. By Judd the term was later adopted as a group name for volcanic and sedimentary classes of rocks. Cf. *Hypogene; Exogenetic.*

Epigenetic.—A term now generally applied to ore-deposits of later origin than the rocks among which they occur; contrasting them with those that are contemporaneous with the enclosing rocks (*syngenetic*).

Equigranular.—A term applied to the texture of rocks whose essential minerals are all of one order of size.

Equilibrium. — The state of a system when all the operative forces so balance each other that the system would continue to remain in the same state indefinitely, provided no change were made in temperature, pressure, or composition.

Erosion.—The action of various mechanical agents in wearing down the land; generally restricted to processes acting by lateral rather than by vertical excavation, those in which the latter action predominates being distinguished under the term *corrosion.*

Espichellite, *Souza-Brandão,* 1907.—A mafic dyke-rock containing phenocrysts of olivine and hornblende with smaller ones of pyroxene, magnetite and pyrite, in a groundmass composed of various mafic minerals, orthoclase-mantled labradorite, and alteration products such as calcite, chlorite, serpentine, and analcite.

(C. Espichel, near Lisbon.)

V. Souza-Brandão: *Ann. Acad. Polytech. do Porto* (Coimbra), 1907, ii, p. 30.

Essential.—A term applied to minerals whose presence in a rock helps to decide the choice of specific name given to the rock, and whose recognition is thus a necessary preliminary to the diagnosis of the rock. An *essential* constituent is not necessarily a *major* constituent, for the presence in a rock of quite small amounts of such minerals as nepheline, olivine, or quartz, may radically affect its classification; these minerals are therefore always *essential,* unless merely local traces are present.

Essexite, *Sears,* 1891.—A phanerocrystalline igneous rock regarded as an alkali variety of gabbro, containing green and purple pyroxenes and plagioclase (andesine to bytownite) with or without soda-amphiboles and olivine. Among the felsic minerals nepheline or analcite may occur in small amounts, and orthoclase or soda-orthoclase is always developed. By decrease in potash-felspar and increase of the felspathoid minerals the type passes into *theralite.* (Essex Co., Mass.)

A. Scott: *Geol. Mag.,* 1915, pp. 455 and 513.

A. Lacroix: *C.R.,* clxx, 1920, p. 20.

Esterellite, *Michel Lévy*, 1897.—A holocrystalline variety of dacite or quartz-microdiorite, containing phenocrysts of quartz, zoned andesine, and hornblende. (Esterel, France.)

A. Michel Lévy: *Bull. Surv. Carte. Géol. France*, ix, No. 57, 1897, p. 19.

Ethmolith, *Salomon*, 1903.—An injected transgressive igneous intrusion, having the form of an irregular funnel. The only example described is that of the Adamello tonalite.

W. Salomon: *Sitz K. preuss. Akad. Wiss., phys-math. Classe*, xiv, 1903, p. 310.

Eucrite, *Rose*, 1835.—A variety of gabbro formed essentially of bytownite-anorthite and augite. The term has also been applied to meteorites of a similar mineral composition.

A. Harker: *Mem. Geol. Surv. Scot.*, 60 (Small Isles), 1908, p. 97.

Eugranitic Texture, *Brögger*.—See **Granitic.**

Euhedral, *Pirsson*, 1896.—See **Idiomorphic.**

Euktolite, *Rosenbusch*, 1899.—See **Venanzite.**

Eulysite, *Erdmann*, 1849.—A granulose variety of pyroxene-peridotite containing manganiferous fayalite and garnet and abundant magnetite. (Tunaberg, Sweden.)

J. Palmgren: *Bull. Geol. Inst. Upsala*, xiv, 1915, p. 109.

Eupholite, *Cordier*, 1868. — A variety of euphotide characterised by the presence of talc.

Euphotide, *Haüy*, 1822. — A term originally synonymous with *gabbro*, and referring to the reflection of light by the green diallage present. The rock to which the name was first applied was afterwards found to have suffered saussuritisation, and consequently the term is now applied to gabbros whose felspars have been altered in that way.

T. G. Bonney: *Phil. Mag.*, xxxiii, 1892, p. 237.

Eurite, *D'Aubuisson*, 1819.—A general term applied to compact felsitic rocks without phenocrysts, hav-

ing the composition of quartz-porphyry or porphyry. The term has also been used in an extended sense to cover all aphanitic rocks of granitic composition whether porphyritic or not.

G. A. J. Cole & A. V. Jennings: *Q.J.G.S.*, xlv, 1889, p. 426.

Eutaxic, *Keyes,* 1901. — A general term applied to stratified ore-deposits, as opposed to those that are unstratified, or *ataxic.*

C. R. Keyes: *Trans. Amer. Inst. Min. Eng.*, xxx, 1901, p. 323.

Eutaxitic Structure.—A term describing the streaked or blotched appearance of certain volcanic rocks due to the alternation of bands or elongated lenses of different colour, composition or texture; the bands, etc., having been originally ejected as individual portions of magma which were drawn out together in a viscous state and formed a heterogeneous mass by welding. Cf. *Flow-breccia.*

Eutectic Mixture. — A discrete mixture (not a compound) of two or more minerals which have crystallised simultaneously from the mutual solution of their constituents, the two or more minerals being in definite proportions. Simultaneous crystallisation sometimes gives rise to graphic texture, but it does not necessarily do so, as the development of graphic intergrowth involves other factors besides eutectic proportions.

A. L. Day: *Bull. Geol. Soc. Am.*, xxi, 1910, p. 147.

Eutectic Point.—The lowest temperature, at any given pressure, at which the constituents of two (or more) minerals can exist together in a liquid state of mutual solution, and at which the two (or more) minerals can crystallise simultaneously in a constant proportion to each other by weight.

Eutectic Ratio.—The ratio by weight of two minerals which crystallise at the eutectic point simultaneously from the mutual solution of their constituents.

Evergreenite, *Ritter,* 1908.—A variety of nordmarkite characterised by the presence of sulphide-ores (chalcopyrite and bornite).

(Evergreen Mine, Colorado.)

E. A. Ritter: *Trans. Am. Inst. Min. Eng.*, xxxviii, 1908, p. 751; *U.S.G.S. Prof. Pap.*, 94, 1917, p. 127.

Exogenetic.—A term applied to geological processes originating at or near the surface of the earth (*e.g.*, denudation and deposition), and to rocks, ore-deposits, and land forms which owe their origin to such processes; contrasted with *Endogenetic.*

T. Crook: *Min. Mag.*, xvii, 1914, p. 72.

Exogenous Enclosures.— = Accidental inclusions, = xenoliths and xenocrysts. See **Enclaves.**

Exomorphism, *Fournet,* 1867.—The modification produced in the invaded rocks by intrusions which traverse them; = *Contact metamorphism* in the usual sense, as opposed to *endomorphism.*

Explosion-tuffs, *Green,* 1919.—Tuffs of which the constituents have been dropped directly into place after being ejected from a volcanic vent, the term thus distinguishing such tuffs from the more ordinary types which are washed into place.

J. F. N. Green: *Proc. Geol. Assoc.*, xxx, 1919, p. 155.

F

Fabric, *C.I.P.W.*, 1902.—A term suggested for that part of a texture which depends on the shapes and arrangement of the constituents of a rock; texture being considered as a function of *crystallinity*, *granularity,* and *fabric.*

Facies.—A term denoting "the sum of the lithological and palæontological characters exhibited by a deposit" regarded as criteria of the conditions which controlled their formation (*e.g.*, alluvial, glacial, littoral facies, etc.). Also applied to varieties of a single body of igneous rock which

differ in structure or composition from the normal rock-type of the mass.

Fahlband. — A Scandinavian mining term for metamorphic rocks heavily impregnated with iron-ores or sulphide minerals.

Fakes.—A vernacular term for platy formations such as micaceous flagstones associated with oil-shales or coal-seams.

False-cleavage, *Harker*, 1885. — See **Strain-slip-cleavage.**

A. Harker : *Rep. Brit. Assoc.* (1885), 1886, p. 836.

Fanglomerate, *Lawson*, 1913.—A term proposed for the coarser deposits occurring in the upper parts of alluvial fans.

A. C. Lawson : *Bull. Dept. Geol. Univ. California*, vii, No. 15, 1913, p. 329.

Farrisite, *Brögger*, 1898. — An aphanitic dyke rock containing barkevikite and diopside as its chief mafic minerals, with lepidomelane, olivine and magnetite in smaller quantities, the felsic minerals felspar and nepheline, being almost entirely altered to, or replaced by zeolites.

(Farris See, Christiania District.)

W. C. Brögger : *Eruptivgest. Kristiania*, iii, 1898, p. 64.

Fasibitikite, *Lacroix*, 1915.—A mesocratic variety of riebeckite-ægirine-granite containing eucolite and zircon. (Ampasibitika, Madagascar.)

A. Lacroix : *C.R.*, clxi, 1915, p. 253.
A. Holmes : *Geol. Mag.*, 1915, p. 267.

Fasinite, *Lacroix*, 1916. — A phanerocrystalline rock composed essentially of augite and nepheline, with subsidiary olivine, biotite, etc. The type is chemically equivalent to berondrite, and differs from bekinkinite by the absence of hornblende and analcite.

A. Lacroix : *C.R.*, clxiii. 1916, p. 257 ; clxx, 1920, p. 20.

Felsic, *C.I.P.W.*, 1912.—A mnemonic term (recalling *fel*spar, *fel*spathoid and *si*lica) for felspathic minerals and quartz actually present in an igneous

rock, and also for rocks largely composed of such minerals; not synonymous with *salic* which refers to the normative compounds of a rock calculated from its analysis.

C.I.P.W.: *Journ. Geol.*, xx, 1912, p. 561.

Felsite.—An igneous rock with or without phenocrysts, in which either the whole or the groundmass consists of cryptocrystalline aggregates of felsic minerals, quartz and orthoclase being those characteristically developed. When phenocrysts of quartz are present the rock is termed *Quartz-felsite* or *Quartz-porphyry*, the latter term being now more customary than the former.

Felsitic.—A term applied to the cryptocrystalline texture seen in the groundmass of quartz-felsites and similar rocks; and which may be original as the result of a rapid cooling of a viscous magma, or secondary, as the result of the devitrification of a natural glass. By many authors this texture is described as *microfelsitic*, the term *felsitic* alone referring only to the aphanitic appearance of a hand specimen. The latter, examined in thin section, may then be *microgranitic, micrographic, orthophyric, micropoikilitic,* or *microfelsitic,* etc.

Felsophyre, *Vogelsang*, 1867. — A general term for porphyries and quartz-porphyries having a felsitic or cryptocrystalline groundmass.

Felspathic-tawite.—A phanerocrystalline rock, intermediate in composition between *tawite* and *sodalite-syenite* composed essentially of sodalite and alkali-felspar (the former being predominant) with ægirine.

J. J. O'Neill: *Geol. Surv. Canada Mem.*, 43 (Pub. No. 1,311), 1914, p. 46.

Femic, *C.I.P.W.*, 1902.—A mnemonic term (recalling *ferro*magnesian) for the group of standard normative minerals, in which the pyroxene and olivine molecules and most of those of the accessory minerals appear. The corresponding term for the

ferromagnesian minerals actually present in a rock is *mafic*.

Fergusite. — A variety of shonkinite or melanocratic nepheline-syenite, containing orthoclase-nepheline pseudomorphs after leucite.

(Fergus Co., Montana.)

L. V. Pirsson : *U.S.G.S., Bull.* 237, 1905, p. 83.

Ferricrete, *Lamplugh*, 1902.—A term suggested for conglomerates formed by the cementation of gravels by the oxidation of percolating solutions of iron salts.

G. W. Lamplugh : *Geol. Mag.*, 1902, p. 575.

Ferrite, *Vogelsang*, 1872. — A general non-committal descriptive term for reddish-brown amorphous alteration products which are presumably ferruginous, but which cannot be definitely diagnosed by ordinary optical methods.

Ferrolite, *Wadsworth*, 1891. — A general term proposed for iron-ore rocks.

Fireclay.—A general term for refractory clays which resist exposure to high temperatures without disintegrating or becoming soft and pasty by melting. Such clays are abundant beneath the coal seams of the Coal Measures, and are characterised chemically by a low content of alkalies and lime.

W. M. Hutchings : *Geol. Mag.*, 1891, p. 164.

J. W. Gregory : *Proc. Roy. Soc. Edin.*, xxx, 191, p. 348.

A. H. Cox : *Geol. Mag.*, 1918, p. 56.

Flaser-gabbro. — A term for dynamically metamorphosed gabbro which has been crushed and sheared into lenticular masses separated by wavy ribbons and streaks of finely granulated and recrystallised material. The phacoidal relics of the original rock have not lost their igneous character, and the rock as a whole has not become a schist.

J. S. Flett : *Mem. Geol. Surv.*, 359 (Lizard), 1912, p. 87.

Flaser-gneiss.—A general term for dynamically metamorphosed rocks, usually igneous, which, like the flaser-gabbro defined above, still contain coarse-

grained lenticular masses or phacoids of parts of the original rock in a finely crystalline foliated groundmass.

Fleckschiefer.—See **Spotted Slates.**

Flint. — A more or less pure siliceous rock composed mainly of granular chalcedony together with a small proportion of opaline silica, and occurring in nodules, irregular concretions, layers, and vein-like masses in the Chalk. The fracture is conchoidal, whereas in *chert* a splintery fracture is more usual.

W. Hill: *Proc. Geol. Assoc.*, xxii, 1911, p. 61.
G. A. J. Cole: *Geol. Mag.*, 1917, p. 64.
W. A. Richardson: *Geol. Mag.*, 1919, p. 535.

Flinty Crush-rock, *Clough.*—A black flinty product of dynamic metamorphism associated with mylonite, and representing a fritted or partly fused variety of the latter; generally structureless, but occasionally showing incipient traces of crystallisation.

Mem. Geol. Surv. (N.W. Highlands), 1907, pp. 124, 221, 249.
S. J. Shand: *Q.J.G.S.*, lxxii, 1916, p. 209.

Flowage.—A term applied to the deformation of rocks, stressed beyond the limit of elastic recovery, by *plasticity* (molecular flow), *granulation* (closely-spaced fracturing), *gliding* (on cleavage planes), or *recrystallisation.*

J. Barrell: *Journ. Geol.*, xxiii, 1915, p. 427.

Flow-breccia. — A term describing lavas in which fragments of partly solidified magma, produced by explosion or flowage, have become welded together or cemented by the still fluid parts of the same magma.

Flow Structure.—A structure, generally, but not necessarily, restricted to volcanic rocks, in which the stream lines of the magma are revealed by alternating bands of differing composition, crystallinity or texture, or by a sub-parallel arrangement of prismatic or tabular crystals.

Fluxion Gneiss, *Gregory,* 1894.—A gneissose or banded igneous rock with a fluxion structure due to the movements of a viscous magma during the later stages of crystallisation. Cf. *Primary foliation.*

Fluxion Structure.—A structure of igneous rocks due to the movement involved in intrusion or to convection, and evidenced by the parallel or sub-parallel disposition of adjacent phenocrysts, or by the alternation of mineralogically unlike layers. The latter type of structure is generally distinguished as *banded.*

F. F. Grout : *Journ. Geol.,* xxvi, 1918, p. 439.

Foliation, *Darwin,* 1846. — A structure represented most characteristically in schists, due to the parallel disposition in layers or lines of one or more of the conspicuous minerals of the rock, the parallelism not being a direct consequence of stratification. The layers may be plane lamellæ, gently undulating or strongly crumpled, or they may be lenticular or phacoidal. Foliation may be described as *closed* when the minerals to which the structure is due form a megascopically felted aggregate, and as *open* when the controlling minerals are megascopically discontinuous or in disconnected groups.

T. G. Bonney : *Geol. Mag.,* 1919, p. 196.

Foliate, *Bastin,* 1909.—A general term for any foliated rock.

Forellenstein, *v. Rath.*— = *Ossypite* = *Troctolite.*

Formation.—A term applied stratigraphically to a set of strata possessing a common suite of lithological and/or faunal characteristics.

Fortunite, *de Yarza,* 1896.—A variety of verite composed of phenocrysts of olivine and phlogopite in a brown glass containing small crystals of pyroxenes, biotite and orthoclase. (Fortuna, Spain.)

A. Osann : *Festschrift H. Rosenbusch,* Stuttgart, 1906, p. 263.

Fourchite, *Williams,* 1890. — An olivine-free monchiquite characterised by an abundance of titanaugite. (Fourch Mts., Montana.)

J. F. Williams: *Geol. Surv. Arkansas Ann. Rep.,* ii, 1890, p. 107.

Foyaite, *Blum,* 1861.—A nepheline-syenite consisting of perthitic-orthoclase, microline, and nepheline, with soda-pyroxenes and/or amphiboles. By *Rosenbusch* the term is applied to all varieties of nepheline-syenite which contain dominantly potash felspars, and this is the common usage of the term. *Brögger,* however, has caused a certain confusion in its use by giving the term a textural significance, all nepheline-syenites with a trachytoid texture being *foyaite* according to his definition. (Foya, Serra de Monchique, Portugal.)

Fruchtschiefer.—See **Spotted Slates.**

Fulgurite, *Arago,* 1821.—A glassy and often tube-like mass produced by the action of lightning on loose or compact rocks.

A. A. Julian: *Journ. Geol.,* ix, 1901, p. 673.

Fuller's Earth.—A very fine-grained deposit consisting chemically mainly of hydrated aluminium silicate, but differing from ordinary clay in its unusually low plasticity. It is used for degreasing wool and for clarifying oil. (Cotteswolds, and Surrey.)

C. L. Parsons: *U.S. Bureau of Mines, Bull.* 71, 1913, p. 6.

G. M. Davies: *Proc. and Trans. Croydon Nat. Hist. and Sci. Soc.,* 1915-16, pp. 63, 92.

Fusain, *Stevenson,* 1911.—A term suggested to replace "mother of coal" and "mineral charcoal"; *i.e.,* for an ingredient of bituminous coal which consists of fibrous strands forming patches and wedges somewhat flattened parallel to the bedding plane. In thin section fusain appears black and nearly opaque, but may show the cellular structure of wood-fibre.

Marie C. Stopes: *Proc. Roy. Soc. B.,* xc, 1919, pp. 472-4, 479.

Fusion Point.—The temperature at which a crystalline substance undergoes a discontinuous change from the solid to the liquid state, absorbing latent heat while the change is effected. The term has no precise meaning as applied to materials such as glass, or rocks composed of more than one mineral. = *Melting-point.*

A. Harker : *Nat. Hist. Ig. Rocks,* 1909, p. 153.
A. L. Day : *Fört. der Min. Krist. Pet.,* iv, 1914, p. 189.

G

Gabbro, *von Buch,* 1810.—A phanerocrystalline rock consisting of labradorite, or bytownite, and augite (generally diallage). With the incoming of olivine the rock becomes *Olivine-gabbro.* If the plagioclase be anorthite, the term *Eucrite* may be used.

W. S. Bayley : *Journ. Geol.,* i, 1893, p. 433.
J. W. Sollas : *Trans. Roy. Irish Acad.,* xxx, 1894, p. 477 (Carlingford).
A. Harker : *Q.J.G.S.,* l, 1894, p. 311 (Carrock Fell).
— *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, p. 102.
— *Mem. Geol. Surv. Scot.,* 60 (Small Isles), 1908, p. 93.
J. S. Flett : *Mem. Geol. Surv.,* 359 (Lizard), 1912, p. 81.
M. N. Nebel : *Econ. Geol.,* xiv, 1919, p. 367 (Duluth).
H. C. Cooke : *Geol. Surv. Canada Mus. Bull.* 30, 1919 (Vancouver).

Gabbro-syenite, *Tarassenko,* 1895. — A descriptive name for rocks now known as *monzonite,* in which the plagioclase is at least as calcic as labradorite. = *Orthoclase-gabbro.* Cf. *Granogabbro*

Gallaston Basalt, *Hatch,* 1892.—A type of the Scottish Carboniferous basalts, intermediate between the *Jedburgh* and *Dalmeny* types; characterised by abundant small phenocrysts of olivine relative to those of plagioclase, in an ophitic groundmass.

F. H. Hatch : *Q.J.G.S.,* xlviii, 1892, p. 129.

Gangue. — A general term for the non-metalliferous mineral aggregates associated with ores in mineral veins.

Ganister.—A compact, highly siliceous sedimentary rock, with a fine and even granular texture; composed of medium to fine grains of angular quartz cemented with silica.

Mem. Geol. Surv. Spec. Rep. Mineral Resources of Great Britain, vi, 1918, p. 3.

Garbenschiefer.—See **Spotted Slates.**

Garéwaite, *Duparc & Pearce*, 1904. — A variety of peridotite-porphyry containing phenocrysts of diopside in a micro-granular groundmass composed of pyroxene, olivine, magnetite, and chromite. (Tilai Range, N. Urals.)

L. Duparc & F. Pearce: *C.R.*, cxxxix, 1904, p. 154.

Garganite. *Viola & de Stefani*, 1893. — A variety of vogesite containing both augite and hornblende.

Gauteite, *Hibsch*, 1897. —A variety of trachyandesite occurring as dykes; a bostonite-like rock with micro-phenocrysts of andesine. (Gaute, Bohemia.)

Geburite-dacite, *Gregory*, 1901. — A holocrystalline variety of dacite occurring as a dyke rock, and characterised by the presence of hypersthene.

J. W. Gregory: *Proc. Roy. Soc. Victoria*, xiv, 1902, p. 193.

Gel.—A colloidal aggregate composed of two phases, as in a jelly; one phase forming a continuous framework enclosing cells occupied by another (liquid) phase.

Generation.—A term applied to each of two or more groups of crystals of the same mineral in igneous rocks, when the sizes of the crystals in the different groups are conspicuously different. Thus, if phenocrysts of orthoclase are embedded in a groundmass containing crystals of orthoclase, the former are said to belong to an earlier *generation* than the latter, and the two groups are considered to indicate different periods of formation corresponding to changes in the cooling conditions.

Geode.—A hollow secretion or concretion, lined with crystals on the inside walls, and separable as a

discrete nodule from the rock (usually argillaceous or calcareous) in which it occurs. Cf. *Druse*.

R. S. Bassler: *Proc. U.S. Nat. Museum*, xxxv, 1908, p. 133.
F. M. Van Tuyl: *Am. Journ. Sci.*, xlii, 1916, p. 34.

Geological Thermometer.—A term applied to known temperature limits within which certain minerals or mineral aggregates must have formed; based on the thermal data relating to the fusion-points of rocks and minerals, and the inversion- or transition-points of allotropic modifications of rock-forming compounds, and in general to the equilibrium conditions and stability ranges under different conditions of pressure for various minerals, allotropes, solid-solutions, eutectics, and other mineral aggregates.

F. E. Wright & E. P. Larsen: *Am. Journ. Sci.*, xxvii, 1909, p. 421.
A. L. Day: *Bull. Geol. Soc. Am.*, xxi, 1910, p. 176.

Geyserite.—A general term for the siliceous deposits, usually opaline, formed around thermal springs and geysers, whether loose, compact, or concretionary.

Ghizite, *Washington*, 1914. — A variety of analcite-basalt characterised by the presence of biotite. (Mt. Ferru, Sardinia.)

H. S. Washington: *Journ. Geol.*, xxii, 1914, p. 748.

Gibelite, *Washington*, 1913. — A variety of alkali-trachyte, containing soda-microcline, with small amounts of colourless to green augite and dark-brown hornblende. (Pantelleria.)

H. S. Washington: *Journ. Geol.*, xxi, 1913, p. 684-91.

Gieseckite-porphyry.—An altered nepheline-porphyry in which porphyritic crystals of nepheline are replaced by scaly sericitic aggregates. = *Liebenerite-porphyry*. (Greenland.)

Gilsonite.—See **Uintaite**.

Giumarrite, *Viola*, 1901. — A variety of amphibole-monchiquite. (Giumarra, Sicily.)

Gladkaite, *Duparc & Pearce,* 1905. — A quartz-lamprophyre containing andesine and hornblende, and in smaller quantities both micas and epidote = *quartz spessartite.* (Gladkaia Sopka, N. Urals.)

L. Duparc & F. Pearce: *Mem. Soc. de Phys. et d'Hist. Nat. Geneva,* xxxviii, 2, 1914, p. 136.

Glass.—A general term for the amorphous consolidation products of magmas, whether forming the whole of a rock, as in obsidian or pumice, or only a groundmass or mesostasis. Glass — natural or artificial—is described physically as a *rigid solution* to distinguish it from *solid solutions* which are necessarily crystalline.

N. L. Bowen: *Journ. Wash. Acad. Sci,* viii, 1918, p. 88.
G. V. Wilson: *Journ. Soc. Glass Tech.,* ii, 1918, p. 177.

Glaucophane-schist, *Barrois,* 1883.—A well-marked type of amphibole-schist, in which glaucophane instead of hornblende is an abundant mineral. Epidote is frequently present, and quartz and mica varieties are recognised.

H. S. Washington: *Am. Journ. Sci.,* xi, 1901, p. 35.
E. Murgoci: *Bull. Dept. Geol. Univ. California,* iv, 1906, p. 359.

Globigerina Ooze, *Ehrenberg & Bailey,* 1853.—A widespread deep-sea deposit largely composed of the shells of foraminifera, among which *Globigerina* is especially abundant. Other calcareous remains are present (about 10 per cent.), together with an inorganic residue (about 3 or 4 per cent.) having the composition of *red clay* (*q.v.*).

J. Murray & A. F. Renard: "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 213.

Globosphærite, *Vogelsang,* 1872. — See **Globulite** below.

Globulite, *Vogelsang,* 1872. — An extremely minute sphere-like crystallite, *i.e.,* having no reaction on polarised light. When loosely aggregated into irregular cloudy masses, the latter are known as *cumulites,* while more closely aggregated masses

are called *globosphærites*. Linear strings of globulites are known as *margarites*.

F. Rutley : *Min. Mag.*, ix, 1891, p. 261.

Glomeroplasmatic, *Lœwinson-Lessing*, 1900.—A term applied to the texture of granites or gneissose rocks in which the individuals of a certain mineral (such as biotite) are locally concentrated into conspicuous open clusters, and not into closed groups as in *glomeroporphyritic* texture.

A. Holmes : *Q.J.G.S.*, lxxiv, 1918, p. 55.

Glomeroporphyritic, *Judd*, 1886.—A texture produced by the segregation of numerous crystals of the same mineral into compact and conspicuous groups which give the rock a porphyritic aspect.

J. W. Judd : *Q.J.G.S.*, xlii, 1886, p. 71.

Gneiss.—A foliated or banded phanerocrystalline rock (generally, but not necessarily, felspathic and of granitic or dioritic composition) in which granular minerals, or lenticles and bands in which they predominate, alternate with schistose minerals, or lenticles and bands in which they predominate. The foliation of gneiss is more "open," irregular, or discontinuous than that of schist (*q.v.*).

J. J. Sederholm : *Bull. Comm. Géol. Finlande*, No. 23, 1907, p. 91.

A. G. Högbom : *Bull. Geol. Inst. Upsala*, x, 1910, p. 29.

J. D. Trueman : *Journ. Geol.*, xx, 1912, p. 236.

J. S. Flett : *Mem. Geol. Surv.* (Lizard), 1912, pp. 55 and 119.

J. J. H. Teall : *Mem. Geol. Surv.* (N.W. Highlands), 1907, chap. v.

A. Holmes : *Q.J.G.S.*, lxxiv, 1917, p. 52.

Gneissose Granite.—A general term for granitic rocks with gneissose structure due, not to metamorphism, but to the constrained movements of a viscous magma during crystallisation = *Granite-gneiss* = *Primary igneous gneiss*.

G. Barrow : *Q.J.G.S.*, xlix, 1893, p. 330.

Gneissose Structure. — The structure of phanerocrystalline rocks, having an open foliation, and intermediate in character between schistose rocks with a closed foliation and granulose rocks

with no foliation. Lamellar or prismatic minerals may be distributed in parallel planes or lines through the more granular body of the rock, or bands and lenticles of granular minerals may alternate with foliæ of lamellar minerals.

Gondite, *Fermor,* 1909. — A spessartite-quartz rock, probably produced by the metamorphism of manganiferous sediments, and named after the Gonds of the Central Provinces of India, where the Gondite Series occurs.

L. L. Fermor : *Mem. Geol. Surv. India,* xxxvii, 1909, p. 306.

Gondite Series, *Fermor,* 1909. — A series of manganiferous metamorphic rocks belonging to the Dharwar System of India, and characterised by the presence of spessartite, rhodonite, and quartz.

Gossan. — A term applied to the weathered or otherwise decomposed upper zone of a lode, characterised by an abundance of oxidised and hydrated alteration products such as limonite.

Grade.—A term applied to those grains of any detrital sediment which are of the same order of size, the latter being conventionally determined by a range of diameters. In the mechanical analysis of sands, etc., the relative proportion of each grade is determined. The following classification of grade-sizes is used for this purpose :—

Name of Grade.		*Range of Diameters.*
Pebbles		Greater than 10 mm.
Gravel		10 mm. ~ 2 mm.
Sand	very coarse sand	2 mm. ~ 1 mm.
	coarse sand	1 mm. ~ 0.5 mm.
	medium sand	0.5 mm. ~ 0.25 mm.
	fine sand	0.25 mm. ~ 0.1 mm.
	superfine sand	0.1 mm. ~ 0.05 mm.
Silt	coarse silt	
	silt	0.05 mm. ~ 0.01 mm.
Mud or clay		Less than 0.01 mm

S. Oden : *Proc. Roy. Soc. Edin.,* xxxvi, 1915-16, p. 219.

P. G. H. Boswell : *British Resources of Sands and Rocks used in Glass Making,* 2nd Ed., 1918, p. 13.

A. Holmes : *The Physical and Geological Characters of Concrete Aggregates,* B.F.P.C. "Red Book," 256, 1920.

Graded Sediments. — A general term for loose or cemented detrital sediments in which the allogenic grains lie mainly within the limits of a single grade.

P. G. H. Boswell : *Sands and Rocks used in Glass Making*, 1918.

Grahamite.—(1) A type of meteorite belonging to the Mesosiderite group; (2) a variety of asphalt or asphaltite having a specific gravity of 1.15, and soluble in carbon disulphide.

G. H. Eldridge : *U.S.G.S.*, *22nd Ann. Rep.*, Pt. 1, 1901, p. 221.

Granite. — A phanerocrystalline rock, consisting essentially of quartz and alkali-felspars with any of the following : biotite, muscovite, and amphiboles and pyroxenes (including soda varieties in the *alkali-granites*). By increase of oligoclase or andesine relative to the alkali-felspars, granite passes through adamellite (quartz-monzonite) to granodiorite and quartz-diorite (tonalite). By decrease of quartz, granite passes through quartz-syenite into syenite.

A. Harker & J. E. Marr : *Q.J.G.S.*, xlvii, 1891, p. 266 (Shap).
W. J. Sollas : *Trans. Roy. Irish Acad.*, xxix, 1891, p. 427 (Leinster).
J. J. H. Teall : *Mem. Geol. Surv.* (Silurian Rocks, Scotland), 1899, p. 607.
P. J. Holmquist : *Bull. Geol. Inst. Upsala*, vii, 1906, p. 77 (Sweden).
Mem. Geol. Surv., 351, 352 (Land's End), 1907, p. 40.
Mem. Geol. Surv., 347 (Bodmin and St. Austell), 1909, p. 54.
R. H. Rastall : *Q.J.G.S.*, lxvi, 1910, p. 116 (Skiddaw).
Mem. Geol. Surv., 338 (Dartmoor), 1912, pp. 27 and 37.
Mem. Geol. Surv. Scot., 53 (Glen Coe), 1916, pp. 119 and 135.
P. Geijer : *Bull. Geol. Inst. Upsala*, xv, 1916, p. 47 (Sweden, Mechanics of Intrusion).
R. H. Rastall & W. H. Wilcockson : *Q.J.G.S.*, lxxi, 1917, p. 592 (Lake District).

Granite-porphyry.—A rock differing from quartz-porphyry by its relative abundance of phenocrysts of granitic minerals, and by a generally coarser groundmass; = *porphyritic microgranite*, which

passes into porphyritic granite as the groundmass becomes phanerocrystalline.

Granitic = Granitoid. — Terms applied to irregularly granular textures like that of a non-porphyritic granite; = *Eugranitic* = *Allotriomorphic-granular.*

Granitite.—Originally used to connote granitic rocks rich in oligoclase, the term is now applied to biotite-granite as defined by Rosenbusch.

Granodiorite, *Becker.*—A rock intermediate in composition between quartz-diorite and quartz-monzonite, and in which the ratio of orthoclase to plagioclase falls between a third and a seventh. The term, however, is rarely used in this strict sense, and is more usually applied to rocks intermediate between quartz-diorite and granite.

Granodolerite, *Shand,* 1917. — A term suggested for oversaturated dolerites containing quartz and orthoclase, these minerals being generally present, but not necessarily, as interstitial micropegmatite.

Granogabbro, *Johannsen,* 1917. — A term suggested for quartz-orthoclase-gabbros, *i.e.*, for phanerocrystalline igneous rocks intermediate between quartz-labradorite-monzonite and quartz-gabbro.

Granolite, *Pirsson,* 1899.—A general term suggested for phanerocrystalline igneous rocks having a granitic as opposed to a porphyritic texture; = *Plutonic rock* (in part).

L. V. Pirsson : *Journ. Geol.,* vii, 1899, p. 141.
W. H. Turner : *Journ. Geol.,* viii, 1900, p. 105.

Granophyre, *Rosenbusch,* 1872. — A fine-grained granitic rock having a micrographic texture, or a granite- or quartz-porphyry having a micrographic groundmass. In an earlier usage of the term (*Vogelsang,* 1867) it connoted a porphyritic rock having a granitic composition, with a microgranular groundmass. Cf. *Graphophyre.* Granophyres are frequently associated with gabbros and corresponding to this and to their comparatively

shallow origin, their chief mafic constituent is frequently augite; biotite-bearing varieties, however, are not uncommon.

A. Harker: *Q.J.G.S.*, li, 1895, p. 125 (Carrock Fell).
T. H. Holland: *Q.J.G.S.*, liii, 1897, p. 416.
— *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, p. 153.
R. H. Rastall: *Q.J.G.S.*, lxii, 1906, p. 253 (Ennerdale).
A. R. Dwerryhouse: *Q.J.G.S.*, lxv, 1909, p. 55 (Eskdale).

Granophyric.—See **Micrographic.**

Granularity.—One of the features involved in the conception of *texture*; the effect due to the magnitudes of the constituent crystals; described by terms such as *phanerocrystalline*, *microcrystalline*, etc.

A. L. Queneau: *School of Mines Quarterly*, xxiii, 1902, p. 181.

Granular Texture.—A texture due to the aggregation of mineral grains of approximately equal size, whether in clastic, igneous, or recrystallised rocks.

W. Cross: *U.S.G.S.*, *14th Ann. Rep.* (1892-3), p. 232.

Granulation.—The fragmentation of minerals strained beyond their elastic limit. The amount of granulation depends not only on the nature of the stresses, but also on the minerals themselves and their sizes and shapes.

C. R. Van Hise: *U.S.G.S. Mon.*, xlvii (Metamorphism), 1904, pp. 673 and 737.

Granulite, *Weiss.* — A granulose metamorphic rock composed of even-sized interlocking granular minerals (*e.g.*, felspars, pyroxenes, and garnet). Parallel or banded structure is due either to the presence of streaks and lenticles of non-granular quartz, or to the alternation of bands in which different minerals predominate; = *Leptynite*. The term *granulite* has been applied to muscovite-granites by Michel-Lévy.

Mem. Geol. Surv. (N.W. Highlands), 1907, p. 64.

Granulitic Structure.—A structure due to the production of granular fragments in a rock by crushing. In France the same term has also been used as synonymous with *panidiomorphic-granitic texture*.

Granulitic Texture, *Judd*, 1886.—A doleritic or basaltic texture due to the arrangement of granular crystals of augite or olivine between a network of felspar laths. Cf. *Intergranular.*

J. W. Judd: *Q.J.G.S.*, xlii, 1886, p. 68.

Granulose Structure.—A structure characteristically developed in granulites, due to the presence of granular minerals, such as quartz, felspars, garnets and pyroxenes, in alternating streaks and bands developed on a megascopic or microscopic scale. Successive layers may differ in colour, texture, or mineral composition, but typical foliation is absent on account of the absence of lamellar or prismatic minerals.

Graphic Granite.—A phanerocrystalline quartz-alkali-felspar rock, in which large crystals of the two minerals are intergrown in such a way that in section the intercalates of quartz have the appearance of cuneiform or semitic characters.

E. S. Bastin: *Journ. Geol.*, xviii, 1910, p. 313.
A. Holmes: *Q.J.G.S.*, lxxiv, 1918, p. 77.

Graphic Texture.—The cuneiform appearance seen in section, due to the interpenetration of quartz and felspar on a megascopic scale. Similar textures, though generally less regular, are sometimes developed between certain other pairs of minerals, the conditions necessary for the development of graphic and allied textures including the simultaneous crystallisation of the minerals concerned from their eutectic. It does not follow, however, that graphic texture is a necessary consequence of eutectic crystallisation.

Graphophyre, *C.I.P.W.*, 1903.—A term suggested in place of *granophyre* (Rosenbusch). The latter term was used by Vogelsang for porphyritic micro-granitic rocks, but as this usage has not been generally adopted, and the term *granophyre* is now universally used in its Rosenbusch sense, no confusion is caused by its retention. The terms

graphophyre and *graphophyric* have not yet been justified by usage, even though their derivation is more accurately descriptive.

Gravel.—A loose detrital sediment in which the predominant grade-size is from 2 to 10 mm. A deposit of more coarsely graded detritus is described as a *pebble-bed*, or a *boulder-bed*. Both stratigraphically and commercially, however, the term *gravel* is used to cover a wider range of grade-sizes than that defined above.

Graywacke.—A term applied to felspathic or tuffaceous grits and coarse sandstones, usually dark in colour, which are strongly cemented, often with an argillaceous binding, and occur characteristically among the older formations = *Grauwacke*.

Greenalite Rock.—A dull dark-green rock of uniform fine grain and conchoidal fracture, containing grains of greenalite in a matrix of chert, carbonate-minerals, and ferruginous amphiboles.

C. R. Van Hise & C. K. Leith: *U.S.G.S., Mon.* lii, 1911, pp. 165, 474.

Green Mud.—A deep sea terrigenous deposit, characterised by a considerable proportion of glauconite; $CaCO_3$ present in variable amounts up to 50 per cent.

J. Murray & A. F. Renard: "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 236.

Greensand. — A general term for sandstones which, when unweathered, have a greenish hue due to the presence of kernels and grains of glauconite.

Green Schist.—A general term for those varieties of schists in which hornblende, chlorite, or epidote are abundant constituents.

Greenstone.—An old field-term applied to more or less altered basaltic or doleritic rocks, the characteristic dark green colour being due to the presence of chlorite, hornblende, epidote, etc., as in diabase and epidiorite.

G. H. Williams: *U.S.G.S. Bull.*, 62, 1890.

J. S. Flett: *Mem. Geol. Surv.* (Land's End), 1907, p. 31.

Greisen, *Werner.* — A primary or pneumatolytically-altered rock of granitic or aplitic texture, containing quartz, and alkali-micas, and generally, though not necessarily, topaz. The process whereby igneous emanations transform granite into greisen is called *greisening* or *greisenisation.*

J. S. Flett : *Mem. Geol. Surv.* (Bodmin & St. Austell), 1909, p. 67.

Griquaite, *Beck,* 1907.—A phanerocrystalline garnet-diopside rock (with or without olivine or phlogopite) occurring as nodular xenoliths in kimberlite pipes and dykes. A variety of *Ariégite.*

T. G. Bonney : *Proc. Roy. Soc., A.,* lxv, 1900, p. 223.

P. A. Wagner : *The Diamond Fields of S. Africa,* 1914, p. 120.

Grit. — This term has been used with many different connotations : for coarse-grained sandstone ; for sands and sandstones, coarse or fine, made up of angular grains ; for sandstones with calcareous cement ; and for sandstones with grains of conspicuously unequal sizes. Stratigraphically it appears in the names of formations so different and variable in grade, angularity, and composition as Millstone Grit, Coniston Grit, Skiddaw Grit, Pea Grit, and *Trigonia* Grit. By Lyell the term was adopted for coarse-grained sandstones, and there is now a tendency to restrict it for petrographic purposes to the cemented detrital sediments corresponding in grade to very coarse sand. Many authors, however, prefer to use the term for loose or cemented sediments which are " gritty " on account of the angularity of the grains.

Grorudite, *Brögger,* 1894. — A microgranitic dyke-rock, containing prisms of ægirine, and, when porphyritic, having phenocrysts of alkali-felspar and ægirine. (Grorud, Christiania.)

W. C. Brögger : *Eruptivgest. Kristiania,* i, 1894, p. 6.

Ground-water.—A general term for the water occupying the interstices and other openings of rocks below the water table; = *Phreatic* water.

For a general classification and discussion of ground-waters, see R. A. Daly: *Econ. Geol.*, xii, 1917, p. 487.

Guano.—A phosphatic deposit, formed from the droppings of sea-fowl in arid regions, which may be friable or compact according to its age and the degree of alteration it has suffered by weathering.

H

Habit. — A term connoting the sum of the external characteristics of a mineral or rock. In its application to rocks the term implies more than structure or texture, including also other features which control the outward appearance, such as lustre, degree of alteration, and fracture. *Habit* may be described broadly by general terms, such as *cenotypal* and *paleotypal*; or particularly by terms referring to the appearance of well-known types, *e.g.*, *tinguaitic habit*, *aplitic habit*, *pegmatoid habit*, etc.

Hälleflinta. — A term applied to granulose rocks of horny aspect which are compact or porphyritic, and sometimes banded. The mineral composition, quartz, felspar, micas, chlorite, etc., indicates a metamorphic origin from quartz-porphyry, rhyolite, or corresponding volcanic tuffs.

Hälleflintgneiss.—A term formerly used in Sweden for rocks that are not called *leptites*.

Haloes.—See **Pleochroic Haloes.**

Haplite.—See **Aplite.**

Harrisite, *Harker,* 1908. — A phanerocrystalline rock composed essentially of black lustrous cleavable olivine with anorthite and a little augite; = *anorthite peridotite.* (Harris, Rum.)

A. Harker: *Mem. Geol. Surv. Scot.*, 60 (Small Isles), 1908, p. 71.

Hartschiefer.—A strongly banded and partly schistose rock due to dynamic metamorphism, and associated with other rocks of mylonitic habit, in which the alternating bands have been produced from ultramylonite by recrystallisation and metamorphic differentiation.

P. Quensel : *Bull. Geol. Inst. Upsala,* xv, 1916, p. 104.

Harzburgite, *Rosenbusch,* 1887. — A peridotite consisting of olivine and orthorhombic-pyroxene ; = *Saxonite.* (Harzburg.)

Hatherlite, *Henderson,* 1898.—A term originally suggested for rocks now known as *leeuwfonteinite ;* = anorthoclase-syenite.

Hauynophyre, *Rammelsberg.*— An analogue of nepheline, in which the place of nepheline is largely taken by haüyne and nosean.

Hawaiite, *Iddings,* 1913. — A general term for rocks of basaltic texture (as contrasted with typical andesite texture), in which the felspar is andesine. (Kilauea, Hawaii.)

Heavy Liquids. — A group of heavy organic liquids, inorganic solutions, and fused salts (*heavy melts*) used for the determination of the specific gravity of mineral particles, or for the separation of minerals, having respectively lower and higher specific gravities than the liquid used, *e.g., Bromoform, Thoulet Solution, Klein Solution, Mercurous nitrate,* etc.

Hedrumite, *Brögger,* 1890.—A leucocratic variety of alkali-syenite containing accessory nepheline. (Hedrum, S. Norway.)

W. C. Brögger : *Eruptivgest. Kristiania,* iii, 1898, p. 183.

Helicitic Structure.—A structure of metamorphic rocks due to the presence in porphyroblastic contact minerals of strings of inclusions representing an earlier schistosity of the rocks.

A. Bäckström : *Geol. Fören i Stockholm Forhandl.,* xl, 1918, p. 167.

Hemicrystalline.—A term applied to igneous rocks to denote that they consist partly of crystals and partly of glass or devitrified glass.

Heptorite, *Busz*, 1904.—A melanocratic haüyne-basanite containing phenocrysts of barkevikite, titan-augite and hauyne, in a glassy or analcitic groundmass containing microlites of labradorite.

(Rhönderfer Thal, Siebengebirge.)

K. Busz: *Neues Jahr.*, ii, 1904, p. 91.

Heronite, *Coleman*, 1899.—A dyke rock consisting of spheroidal groups of orthoclase in a base of analcite containing radiating bundles of labradorite and, in smaller quantity, ægirine; since shown to be an altered tinguaite.

(Heron Bay, Ontario.)

A. P. Coleman: *Journ. Geol.*, vii, 1899, p. 435.
E. A. Barlow: *Cong. Géol. Inter.*, xii, Guide 8, 1913, p. 17.

Heteromorphic, *Lacroix*, 1917. — A term applied to rocks of similar chemical composition, but of different mineral composition; as, for example, where leucite and olivine in one rock may be represented by biotite in another.

A. Lacroix: *C.R.*, clxv, 1917, p. 486; clxx, 1920, p. 23.

Heumite, *Brögger*, 1898.—A fine grained melanocratic dyke-rock composed of alkali-felspars, nepheline, and sodalite, with barkevikite, biotite, and augite as abundant mafic constituents.

(Heum, S. Norway.)

W. C. Brögger: *Eruptivgest. Kristiania*, iii, 1898, p. 90.

Hexahedrite, *Rose*. — A group name for those iron meteorites which have a cubic cleavage, and which, on being etched, reveal a system of fine lines (Naumann Lines) due to twinning parallel to the octahedral faces.

Hiatal Fabric, *C.I.P.W.*, 1906.—A variety of inequigranular texture in which the sizes of the crystals are not continuously graded, but form a broken series, as in most rocks exhibiting porphyritic and poikilitic textures.

J. P. Iddings: *Igneous Rocks*, I, 1909, p. 198.

Hillhouse Basalt, *Hatch*, 1892.—A type of the Scottish Carboniferous basalts; characterised by numerous microphenocrysts of olivine and fewer of augite, in a fine groundmass in which augite predominates; = *Picrite-basalt.*

J. S. Flett: *Mem. Geol. Surv. Scot.* (Edinburgh), 1910, p. 316.

Hirnantite, *Cope*, 1915.—A variety of albite-keratophyre, or albitised tholeiite, containing laths of sodic plagioclase embedded in an interstitial base of chlorite, with smaller amounts of calcite, quartz, leucoxene and hæmatite.

(Craig-ddu Hirnant, Berwyn Hills.)

T. H. Cope: *Proc. Liverpool Geol. Soc.* (Cope Memorial Vol.), 1915, p. 79.

Högbomitite, *Gavelin*, 1917. — See **Magnetite-högbomitite.**

Holocrystalline. — A term applied to igneous rocks completely made up of crystals.

Hololeucocratic, Holomelanocratic, *Lacroix*, 1902.—Terms applied to facies of igneous rocks, or to members of a series of related rocks, which are almost completely composed of light or dark minerals respectively.

A. Lacroix: *Nouv. Arch. du Mus. d'Hist. Nat.*, 1, 1902, p. 161.

Holyokeite, *Emerson*, 1902.—A variety of albite-diabase containing 70 per cent. albite, 9 per cent. orthoclase, and 16 per cent. calcite, with smaller amounts of accessory minerals.

(Holyoke, Mass., U.S.A.)

B. K. Emerson: *Journ. Geol.*, x, 1902, p. 510.

Homœoblastic, *Becke*, 1903.—A term used instead of *equigranular* and applied to metamorphic rocks to indicate that the texture so described is due to recrystallisation.

Hornblende-schist.—A schist in which hornblende is the dominant mineral: plagioclase and sometimes quartz being the chief felsic constituents. With

loss of schistose structure the rock passes into hornblende-gneiss and amphibolite.

J. J. H. Teall: *Q.J.G.S.*, xli, 1885, p. 133.
T. G. Bonney: *Q.J.G.S.*, lii, 1896, p. 18.
J. S. Flett: *Mem. Geol. Surv.* (Lizard), 1912, p. 44.

Hornblendite, *Dana*, 1880.—A phanerocrystalline igneous rock essentially composed of hornblende. Olivine-hornblendite is the passage rock to hornblende-peridotite.

Hornfels.—A contact metamorphosed rock, usually of speckled granular appearance, but not typically schistose, nor strictly granulose, consisting essentially of quartz, micas, and felspars, with or without garnet, andalusite, or cordierite, and more rarely pyroxene or amphibole. Any cleavage or incipient schistosity possessed by the parent rock is obliterated by a new structure which may be described as *maculose*.

J. S. Flett: *Mem. Geol. Surv.* (Dartmoor), 1912, p. 45.
H. Backlund: *Geol. Fören i Stockholm Forhandl.*, xl, 1918, p. 184.

Hornstone.—A general term for compact, tough, siliceous rocks having a splintery or sub-conchoidal fracture; distinguished from flint and chert by greater opacity in thin flakes and the presence of a veined, banded, or other parallel structure such as lamination or cleavage.

Howardite, *Rose*, 1863. — An achondritic meteorite containing bronzite, olivine, and anorthite, with little or no iron.

Hudsonite, *Cohen.* - The term originally suggested for rocks now known as *Cortlandtite*. The latter term is generally adopted as *hudsonite* had previously been given to a variety of pyroxene.
(Hudson R., New York.)

Hullite.—A soft dark substance occurring as interstitial matter and amygdaloidal infillings in Antrim basalts. It is of the same nature as palagonite,

but differs from the latter in having a low specific gravity, viz., 1.76.

(Carnmoney Hill, near Belfast.)

G. A. J. Cole : *Rep. Belfast Nat. Field Club,* 1894-5, p. 1.
J. J. H. Teall : *Q.J.G.S.,* liii, 1897, pp. 485-6.

Humic Coals, *Potonié,* 1904. — A group of coals, including the ordinary bituminous varieties, which have been formed from accumulations of vegetable-débris that have maintained their morphological organisation with little decay.

Marie C. Stopes & R. V. Wheeler : *The Constitution of Coal,* 1918, p. 19.

Hunne Diabase, *Törnebohm,* 1877.—A type of quartz-dolerite containing hornblende, biotite and a little quartz, in addition to plagioclase and a pale augite (sahlite). Interstitial chloritic matter is often present, and the type is frequently somewhat porphyritic in aspect. Cf. *Konga Diabase.*

(Hunneberg, Sweden.)

Hyalo-.—A prefix added to certain rock names to signify a glassy rock of corresponding chemical composition, *e.g., hyalo-basalt.*

Hyalomelane, *Haussmann,* 1847.—A name given to basaltic glass at a time when the latter was considered to be a definite mineral species.

Hyalo-ophitic Texture, *Polenov,* 1899.—A texture resembling ophitic texture, in which the spaces of an open network of felspar laths are occupied by glass; a limiting case of intersertal texture.

Hyalopilitic.—A groundmass texture in which laths or microlites of felspar are interwoven (as in a felt) with glass occupying the interstices between adjacent crystals.

Hybrid, *Durocher,* 1857.—A term originally applied to "intermediate" rocks at a time when they were regarded as the products of composite magmas derived from the admixture of the "trachytic" and "pyroxenic" magmas of Bunsen. By *Harker,* 1904, the term is adopted for abnormal igneous

rocks, of which *Marscoite* is an example, formed by the mixture of two magmas, or by the assimilation of a rock already consolidated by the magma of a later intrusion.

A. Harker : *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, p. 181.

— *Nat. Hist. Ig. Rocks,* 1909, p. 333.

Hydatogenesis.—The process whereby mineral deposits are formed from magmatic solutions rich in water. The term is also employed by some authors for all deposits formed from aqueous solution whether the waters be magmatic, vadose, or phreatic.

Hydatogenous, *Renevier,* 1880. — A term applied to chemical deposits of aqueous origin, including vein deposits.

Hydrothermal.—A term applied to magmatic emanations rich in water; to the processes in which they are concerned; and to the rocks or ore-deposits, alteration products, and springs produced by them.

G. W. Morey & P. Niggli : *Journ. Am. Chem. Soc.,* xxxv, 1913, p. 1086.

E. A. Stephenson : *Journ. Geol.,* xxiv, 1916, p. 180.

Hypabyssal.—A general term applied to minor intrusions, such as sills and dykes, and to the rocks of which they are made, to distinguish them from volcanic rocks and formations on the one hand, and "plutonic" rocks and major intrusions such as batholiths on the other.

Hyperite, *Elie de Beaumont.*—A term at first synonymous with *Norite,* now extended to include somewhat granular hypersthene-felspar rocks with or without augite, diallage, or garnet.

J. J. H. Teall : *Mem. Geol. Surv.* (Sil. Rocks, Scotland), I, 1899, p. 613.

Hypersthenite. — A rock composed wholly or almost wholly of hypersthene. Small amounts of other pyroxenes, plagioclase, or olivine may be present.

Hypidiomorphic, *Rosenbusch.* — A general term applied to those forms of igneous rock-minerals which are bounded only in part by their characteristic crystal faces, *i.e.,* for forms intermediate between *idiomorphic* and *allotriomorphic;* = *Subhedral;* = *Hypautomorphic.*

Hypidiomorphic Texture.—A texture of igneous rocks due to the development of the greater proportion of the minerals in crystals having hypidiomorphic forms.

Hypocrystalline. — A term applied to igneous rocks made up partly of crystals and partly of glass.

Hypogene, *Lyell,* 1833.—A general term intended to include both plutonic and metamorphic classes of rocks, that is, for rocks formed within the earth. By *A. Geikie,* 1879, the term was used for geological processes originating within the earth, and if it were applied to rocks in this sense, it would therefore include volcanic rocks, which were intentionally excluded by Lyell from his *hyogene* rocks. Cf. *Epigene; Endogenetic.*

Hysterobase, *Lassen,* 1888.—A variety of diabase containing plagioclase, quartz, biotite, and brown hornblende, the latter paramorphic after augite.

I

Idioblast, *Becke,* 1903. — A term applied to pseudo-idiomorphic crystals, such as garnet, occurring in metamorphic rocks. An idioblast may be high in the *crystalloblastic* order of the minerals present, but it has no significance in relation to order of crystallisation, as would be the case in igneous rocks.

Idiomorphic, *Rosenbusch.*—A general term applied to the forms of igneous rock-minerals which are completely bounded by the crystal faces peculiar to the species; = *Euhedral;* = *Automorphic.*

Ijolite, *Ramsay,* 1891. — A phanerocrystalline rock essentially composed of nepheline and ægirine-augite or other pyroxene free or nearly free from normative plagioclase. Cf. *Fasinite.*

(Ijola, Finland.)

V. Hackman : *Bull. Comm. géol. Finlande,* No. 11, 1900.

Ijussite, *Rakovski,* 1911. — A variety of teschenite-pyroxenite containing abundant titanaugite and barkevikite, with small amounts of bytownite, anorthoclase and analcite. (Ijuss R., Siberia.)

J. Rakovski : *Trans. Mus. Pet. Or. Ac. Sci. St. Pet.,* v, 1911, p. 256.

Ilmenite-norite, *Kolderup,* 1896.—A variety of norite (hypersthene and labradorite) with a high percentage of ilmenite varying in different parts of the rock-mass from 20 to 80 per cent.

Ilmenitite, *Kolderup,* 1896. — A facies of ilmenite-norite consisting predominantly of ilmenite.

C. F. Kolderup : *Bergen Mus. Aarb.,* v, 1896, p. 178.

Imandrite, *Ramsay,* 1894. — A rock composed of quartz and albite, due to interaction between a nepheline-syenite magma and graywacké.

(Umptek, Kola.)

W. Ramsay & V. Hackman : *Fennia,* xi, 1894, p. 74.

Impregnation.—A term expressing the irregular distribution of introduced mineral matter through a previously formed rock; contrasted with *dissemination* which expresses distribution without implication as to order of deposition.

Impsonite, *Eldridge,* 1901. — A variety of asphaltite having a specific gravity of 1.175, characterised by a hackly fracture, and by being soluble in carbon disulphide to the extent of about 35 per cent.

G. H. Eldridge : *U.S.G.S., 22nd Ann. Rep.,* Pt. 1, 1901, p. 221.

Inclusion.—A general term for foreign bodies (gas, liquid, glass, or mineral) enclosed by minerals; also extended in its English usage to connote *en-*

closures of rocks and minerals within igneous rocks, such as *cognate* and *accidental* inclusions. It is, however, desirable to distinguish *inclusions*, *enclosures*, and *segregations* (*q.v.*).

J. A. Smythe: *Geol. Mag.*, 1914, p. 244.
S. Powers: *Journ. Geol.*, xxiii, 1915, p. 1.

Indurated.—A term technically restricted to compact rocks that have been hardened by the action of heat.

Ingenite, *Forbes*, 1867.—A general term for igneous rocks "born, bred, or created within or below." By *Kinahan*, 1873, the term was extended to include metamorphic rocks as well as the igneous rocks alone considered by Forbes. Cf. *Derivate.*

Injection Gneiss.—A gneiss whose banding is wholly or partly due to the lit-par-lit, or interlaminar, injection of granitic magma into schistose, fissile, or otherwise penetrable rocks; = (in part) *Composite Gneiss.*

Inninmorite, *Thomas & Bailey*, 1915.—A porphyritic rock containing phenocrysts of plagioclase (labradorite to anorthite) and augite, in a groundmass of more sodic plagioclase, augite, and abundant glass. (Inninmore, Morven.)

E. M. Anderson & E. G. Radley: *Q.J.G.S.*, lxxi, 1916, p. 205.

Intercalate.—A term applied generally to a body of one kind of material interlaminated with another; and particularly to lamellar inclusions of one mineral in another, the former being orientated more or less exactly in planes related to the crystal structure of the latter, *e.g.*, in perthite (intercalates of plagioclase in orthoclase), and in certain minerals characterised by schiller structure.

Intergranular, *Evans*, 1916.—A texture characteristic of holocrystalline basalts and doleritic rocks, due to the aggregation of grains of augite (not in optical continuity, as in sub-ophitic texture) between felspar laths arranged in a network that may be diverse, sub-radial, or sub-parallel; distinguished

from *intersertal* by the absence of interstitial glass, or other substances that take the form of the interstitial spaces. Cf. *Granulitic Texture.*

A. Holmes: *Min. Mag.*, xviii, 1918, p. 191.

Intersertal, *Zirkel,* 1870.—A texture characterised by the insertion between divergent laths of felspar of glass, palagonite, chlorite, or other primary or secondary minerals that take the form of the interstitial spaces. In intersertal basalts, the grains of augite rarely occupy the wedge-shaped spaces completely, continuity being established by a mesostasis of glass or its alteration products.

Intratelluric, *Rosenbusch.* — A term applied to the period of crystallisation of a magma anterior to its effusion as a lava, and represented in many volcanic rocks by phenocrysts formed under comparatively deep-seated conditions. Such crystals, belonging to an earlier generation than the groundmass, are also described as intratelluric.

Isenite, *Bertels,* 1874.—A felspathoid-bearing variety of hornblende-trachyandesite, having phenocrysts of andesine, soda-microline, hornblende and biotite, in a groundmass of oligoclase, orthoclase, and nosean, with small amounts of augite, apatite and iron-ores. (Nassau.)

Isomorphous.—A term applied to two or more minerals or other crystalline bodies which form an *isomorphous series* when they are related by close similarity of chemical constitution, and crystallise in the same class of the same system of symmetry, developing the same forms with angles that differ by not more than a few degrees. Such minerals can form intimate crystalline mixtures or solid solutions (*e.g.*, albite and anorthite), in which the physical properties change continuously with the composition. Certain minerals are imperfectly isomorphous (*e.g.*, albite and orthoclase) when one

or more of the above criteria fails to hold, and only a limited amount of one mineral is capable of being molecularly dispersed through the other.

A. L. Day & E. T. Allen: *Am. Journ. Sci.*, xix, 1905, p. 93 (Felspars).

A. L. Day: *Bull. Geol. Soc. Am.*, xxi, 1910, p. 147.

A. E. H. Tutton: *Crystalline Structure and Chemical Constitution*, 1910, p. 124.

Issite, *Duparc & Pamfil,* 1910. — A melanocratic dyke rock containing hornblende, with a smaller quantity of green pyroxene and a variable but always subsidiary amount of labradorite; = *melanocratic hornblende-gabbro, or felspathic hornblendite.*

L. Duparc & P. Pamfil: *C.R.*, cli, 1910, p. 1136; *Bull. Soc. Min. France*, xxxiii, 1910, p. 351.

Itabirite, *Eschwege.*—A variety of quartzite containing abundant iron-ore minerals, with accessory oligoclase and muscovite. (Itabira, Brazil.)

Itacolumite, *Humboldt.* — A schistose and flexible variety of quartzite containing micaceous minerals (mica, chlorite, talc) in addition to the chief constituent, quartz. (Mt. Itacolumi, Brazil.)

R. D. Oldham: *Rec. Geol. Surv. India,* xxii, 1889, p. 51.

G. W. Card: *Geol. Mag.*, 1892, p. 120.

Invernite, *Watts,* 1895. — A holocrystalline intrusive rock of granitic aspect containing phenocrysts of orthoclase and fewer of plagioclase in a groundmass consisting of stumpy idiomorphic felspars (mostly orthoclase but in part plagioclase), sparsely distributed hornblende or mica, and interstitial quartz.

W. W. Watts: In *Guide to the Collections of Rocks and Fossils, Geol. Surv. Ireland*, 1895, p. 93.

J

Jacupirangite, *Derby,* 1891. — A term applied to a melanocratic series of igneous rocks of varying composition, the characteristic minerals being purple titanaugite, nepheline, and magnetite or

titanoferrite. The chief types range from ijolite-like rocks (pyroxene-nepheline rocks with some biotite and olivine) to alkali-pyroxenites, and from each of these to varieties rich in magnetite.

(Jacupiranga, Brazil.)

H. S. Washington : *Journ. Geol.*, ix, 1901, p. 620.

Jadeitite. — A rock consisting of the alkali-pyroxene jadeite associated with small amounts of felspar or felspathoid, and probably derived from alkali-igneous rocks by high-pressure metamorphism.

Jasperisation. — The alteration of rocks, igneous or sedimentary, into banded jaspilite-like rocks by metasomatic processes in which iron-oxides and silica are successively introduced.

A. E. V. Zealley : *Trans. Geol. Soc. S. Africa,* xvi, 1918, p. 43.

Jasperoid.—A term sometimes used for limestones and calcareous rocks, in which the carbonates have been replaced by fine-grained quartz aggregates or chalcedony. Rocks of this kind are generally grey, and chert-like in appearance, and they are often developed as the gangue of metasomatic sulphide deposits, particularly those of the silver-lead type.

Jaspilite.—A term applied to rocks composed of inter-banded layers respectively rich in silica (quartz or chalcedony) and iron-oxides (magnetite, hæmatite, etc.). The chert-like bands have a red colour owing to the inclusion of flakes of hæmatite. Variable amounts of ferruginous amphiboles are generally present, and the rocks are not only conspicuously banded, but are often contorted and brecciated.

C. R. Van Hise & C. K. Leith : *U.S.G.S., Mon.* lii, 1911, pp. 124, 464, 466.

C. R. Van Hise : *Journ. and Proc. Roy. Soc. West Aust.*, ii, p. 23.

Jedburgh Basalt, *Watts*, 1897.—A type of the Scottish Carboniferous basalts; characterised by inconspicuous phenocrysts of olivine and plagioclase in an ophitic to microlitic groundmass, to which augite is almost always restricted.

E. B. Bailey: *Mem. Geol. Surv. Scot.* (Glasgow District), 1911, p. 138.

G. W. Tyrrell: *Trans. Geol. Soc. Glasgow*, xiv, 1912, p. 226.

Jet.—A hard coal-black variety of lignite, showing the structure of coniferous wood under the microscope.

Mem. Geol. Surv. Spec. Rep., Mineral Resources of Great Britain, vii, 1918.

Josefite, *Szadeczky*, 1899.—An altered microgranular dyke rock consisting of augite and olivine, with abundant serpentine and calcite. (Assuan.)

Jumillite, *Osann*, 1906. — A fine-grained porphyritic rock containing phenocrysts of orthoclase (with poikilitic inclusions of olivine), phlogopite and soda-pyroxenes and amphiboles in a matrix of soda-amphibole and leucite, with accessory apatite and titanoferrite. (Jumilla, Murcia, Spain.)

A. Osann: *Festschrift H. Rosenbusch*, 1906, p. 263.

Juvenile, *Suess*, 1902.—A term applied to water and other volatile materials that are known to be magmatic emanations of primary endogenetic origin. Those of secondary endogenetic origin—occurring as emanations derived from country rock—are distinguished by Daly as *Resurgent*.

R. A. Daly: *Econ. Geol.*, xii, 1917, p. 489.

K

Kaiwekite, *Marshall*, 1906.—An olivine-bearing variety of alkali-trachyte or trachyandesite, approximately representing the volcanic equivalent of laurvikite. The rock contains phenocrysts of anorthoclase, titanaugite mantled with ægirine, barkevikite, and olivine, in a groundmass of oligoclase with small amounts of pyroxene and magnetite. (North Head, Otago, N.Z.)

P. Marshall: *Q.J.G.S.*, lxx, 1914, p. 390.

Kakirite, *Svenonius.* — A megascopically sheared and brecciated cataclastic rock in which fragments of the original material are surrounded by innumerable gliding surfaces in which intense granulation and some recrystallisation have taken place.

(Lake Kakir, Swedish Lapland.)

P. Quensel: *Bull. Geol. Inst. Upsala,* xv, 1916, p. 100.

Kakortokite, *Ussing,* 1911. — A banded nepheline-syenite containing leucocratic layers rich in felspar and nepheline (white), others rich in eudialite and nepheline (red), and melanocratic layers rich in ægirine and arfvedsonite (black).

N. V. Ussing: *Medd. om Grönland,* xxxviii, 1912, p. 177.

Kankar.—A vernacular Indian term for *stone;* now restricted to concretionary masses of calcium carbonate occurring in alluvium; = *Kunkar.*

Kaolin.—Kaolin is a white, or slightly stained, clay, due to the decomposition of a highly felspathic rock, and therefore also containing a variable proportion of other constituents derived from the parent rock. The clay-substance itself is essentially a hydrated silicate of alumina, and to this material the name *kaolinite* is frequently given. The word *kaolin* is derived from the Chinese *kuling*, meaning "high ridge," the ridge referred to, near Jaochau Fu, having been wrongly considered to be the site of an important deposit which actually lies at the foot of the ridge. See *China-clay.*

J. A. Howe: *Mem. Geol. Surv.* (Kaolin, China Clay and China Stone), 1914.

W. R. Jones: *Clays of Economic Importance in the F.M.S.,* Govt. Press, Kuala Lumpur, 1915.

Kaolinisation.—The processes whereby felspars, and other alumino-silicates, are altered to kaolin.

J. A. Howe: *Mem. Geol. Surv.* (Kaolin, China Clay and China Stone), 1914, p. 135.

Karite, *Karpinsky,* 1904.—A variety of grorudite containing about 50 per cent. of quartz.

(R. Kara, Siberia.)

Kassaite, *Lacroix*, 1918.—A microlitic dyke-rock containing phenocrysts of hauyne, barkevikite, augite and labradorite in a groundmass of hornblende and felsic minerals. (Los Archipelago.)

A. Lacroix: *C.R.*, clxvi, 1918, p. 542.

Kata-, *Grubenmann*, 1907.—A prefix used as a qualifier to the group-names suggested by Grubenmann for metamorphic rocks, to indicate that the type so distinguished belongs to the deepest zone of metamorphism. In this zone the distinctive physical conditions are very high temperature and hydrostatic pressure, and comparatively feeble stress, and the rocks characteristically produced include biotite-, sillimanite-, cordierite-, garnet-, and pyroxene-gneiss, granulites, and eclogite. Cf. *Epi-*, and *Meso-*.

U. Grubenmann: *Die Kristallinen Schiefer*, II, 1907, pp. 21, 172.

Kataclastic.—See **Cataclastic,** *Kjerulf*.

Katagneiss.—A term applied to gneisses, amphibolites, etc., considered to have been formed in the deepest zone of metamorphism, where high temperature is a controlling factor, and high hydrostatic pressure dominates over shearing stress. (Note the different sense in which *kata-* is used in the following term.)

Katamorphism, *Van Hise*, 1904. — The alteration of rocks by weathering and cementation, the characteristic changes involving the production of simple compounds from more complex minerals.

C. R. Van Hise: *U.S.G.S. Mon.*, 47, 1904.

C. K. Leith & W. J. Mead: *Metamorphic Geology*, 1915.

Katzenbuckelite, *Osann*, 1903.—A porphyritic rock of tinguaitic habit having phenocrysts of nepheline, nosean, biotite, and olivine, in a glassy or cryptocrystalline groundmass containing minute crystals of nepheline, leucite, orthoclase, biotite and soda-pyroxenes and amphiboles.

(Katzenbuckel, Odenwald, Baden.)

A. Osann: *Tschermak's Min. Pet. Mitt.*, xxi, 1903, p. 365.

Kauaiite, *Iddings,* 1913.—A coarse gabbro-like rock containing augite and olivine and zoned felspars ranging from calcic labradorite in the inner to alkali-felspar in the outer zones; = *olivine-augite-diorite.* (Hawaiian Is.)

W. Cross: *U.S.G.S., Prof. Pap.,* 88, 1915, p. 15.

Kedabekite, *Fedorof,* 1901.—A garnetiferous variety of gabbro or eucrite, in which the plagioclase is anorthite. (Kedabek Caucasus.)

Kelyphitic, *Schrauf,* 1882. — A term applied to the "rims" or "borders," composed of microcrystalline aggregates of pyroxene or amphibole, which sometimes appear around olivine where it would otherwise be in contact with plagioclase, or around garnet where it would otherwise be in contact with olivine or other magnesium-rich minerals. Bonney suggests that the term be restricted to occurrences of secondary origin, applying the term *Corona* to those that are primary.

J. J. Sederholm: *Bull. Comm. Geol. Finlande,* No. 48, 1916, p. 47.

Kentallenite, *Hill & Kynaston,* 1900.—A phanerocrystalline rock consisting essentially of olivine (dusty in thin section), pale-green augite, biotite, plagioclase, and orthoclase. Some varieties may be regarded as melanocratic *olivine-monzonite,* but in others orthoclase is inconspicuous or *occult.* (Kentallen, Loch Linnhe.)

J. B. Hill & K. Kynaston: *Q.J.G.S.,* lvi, 1900, p. 531.

Kenyte, *Gregory,* 1900.—A variety of alkali-trachyte, containing phenocrysts of anorthoclase in a hyalopilitic or trachytic base. Ægirine-augite is present, and, in some varieties, olivine. (Mt. Kenya, B.E.A.)

J. W. Gregory: *Q.J.G.S.,* lvi, 1900, p. 205.
G. T. Prior: *Min. Mag.,* xiii, 1902, p. 246.

Keralite, *Cordier,* 1868.—A variety of hornfels having quartz and biotite as its essential minerals.

Keratophyre, *Gümbel,* 1874. — A soda-porphyry or trachyte containing albite-oligoclase or anortho-

clase in an orthophyric or felsitic groundmass; pyroxenes, often altered to chlorite, epidote, etc., may be present.

A. H. Cox: *Rep. Brit. Assoc.* (Birmingham, 1913), 1914, p. 496

Kersantite, *Delesse,* 1851. — A dioritic lamprophyre characterised by biotite and plagioclase.

(Kersanton.)

Khagiarite, *Washington,* 1913. — A black vitreous variety of pantellerite containing phenocrysts of soda-microcline, diopside, ægirine-augite, and cossyrite, in a groundmass of brown glass having a flow texture due to the arrangement of microlites or crystallites. = *Hyalo-pantellerite.*

H. S. Washington: *Journ. Geol.,* xxi, 1913, p. 708.

Khondalite Series, *Walker,* 1902.—A series of metamorphic rocks (named after the Khonds of India, in whose country they occur), consisting of garnet-quartz-sillimanite rocks with garnetiferous quartzites, graphite-schists and calciphyres.

T. L. Walker: *Mem. Geol. Surv. India,* xxxiii, 1902, p. 11.

Kidlaw Basalt, *Bailey,* 1910.—A type of the Scottish Carboniferous analcite-basalts; characterised by numerous microphenocrysts of olivine and augite in a groundmass notable for the relative abundance of orthoclase and biotite and the presence of analcite in large poikilitic crystals.

E. B. Bailey: *Mem. Geol. Surv. Scot.* (East Lothian), 1910, pp. 105-113.

Kieselguhr.—See **Diatomite.**

Killas.—A Cornish mining term for the altered, schistose, or hornfelsic rocks in contact with granite, and often considerably modified by emanations from the latter.

Kilsyth Basalt, *Watts,* 1897.—A variety of the *Markle* type (*q.v.*) of the Scottish Carboniferous basalts, characterised by sub-ophitic texture.

Kimberlite, *Carvill Lewis,* 1887.—A brecciated biotite-peridotite, occurring in the diamond-pipes of South Africa. (Kimberley.)

P. A. Wagner: *The Diamond Fields of S. Africa,* 1914, p. 78.

D. Draper & W. H. Goodchild: *Mining Journ.*, cxiii, 1916, pp. 357, 365.

Kinne Diabase, *Törnebohm,* 1877.—A type of olivine-diabase containing intersertal chloritic matter and secondary quartz.

Kinzigite, *Fischer,* 1860.—A coarsely granulose rock formed by the metamorphism of sedimentary rocks of appropriate composition, and essentially composed of garnet and biotite, with varying amounts of quartz, orthoclase, oligoclase, muscovite, cordierite, or sillimanite. (Kinzig, Schwarzwald.)

Klein Solution.—A yellow aqueous solution of cadmium boro-tungstate, somewhat viscous when saturated, having a maximum specific gravity of 3.28.

W. B. D. Edwards: *Geol. Mag.,* 1891, p. 273.

Knotted Schist or **Knotenschiefer.** — See **Spotted Slates.**

Kodurite, *Fermor,* 1907.—The type rock of the *Kodurite Series,* composed of potash felspar, spandite (a garnet intermediate between *sp*essartite and *and*radite), and apatite. (Kodur Mines, Vizagapatam, India.)

L. L. Fermor: *Rec. Geol. Surv. India,* xlii, 1912, p. 208.

Kodurite Series, *Fermor,* 1907.—A series of rocks of uncertain but probably igneous origin, associated with the Archæan complex of Madras, and ranging from quartz-orthoclase rocks through *Kodurite* to spandite-rock and manganese-pyroxenites.

L. L. Fermor: *Mem. Geol. Surv. India,* xxxvii, 1909, p. 243.

Kohalaite, *Iddings,* 1913.—A general term for oligoclase-andesites. (Kohala Mt., Hawaiian Is.)

Kolm.—A variety of coal occurring locally as lenticles in Swedish alum-shales, and containing about 30

per cent. of ash, which is remarkable for its high content of rare metals, including uranium and radium.

Konga Diabase, *Törnebohm*, 1877.—A type of granodolerite containing calcic labradorite laths and intergranular augite (sahlite) and orthorhombic pyroxene, in a microgranitic interstitial mass of quartz and orthoclase. Cf. *Hunne diabase.*

(Konga, Sweden.)

Koswite, *Duparc*, 1902. — A variety of olivine-pyroxenite containing diopside as its chief constituent with olivine in moderate amount, and magnetite acting as an interstitial cement.

(Koswinsky, N. Urals.)

L. Duparc & P. Pamfil: *Bull. Soc. Min. France*, xxxiii, 1910, p. 251.

Krablite, *Forchhammer*, 1832.—A variety of crystal-tuff containing abundant sanidine, with plagioclase, augite, and quartz in smaller proportions.

(Mt. Krabla, Iceland.)

Krageröite, *Brögger*, 1904.—An albite-aplite in which the place of quartz is largely taken by rutile; = *Kragerite.* (Kragerö, S. Norway.)

T. L. Watson: *Am. Journ. Sci.*, xxxiv, 1912, p. 569.

Kulaite, *Washington*, 1894. — A nepheline- or leucite-bearing trachydolerite in which hornblende is the dominant mafic mineral; varieties in which orthoclase cannot be recognised resemble *tephrite.*

(Kula Devit, Lydia, Asia Minor.)

H. S. Washington: *Journ. Geol.*, viii, 1900, p. 610.

Kullaite, *Hennig*, 1899.—A variety of diabase containing red phenocrysts of plagioclase and microcline.

(Kullen, Sweden.)

Kunkar.—See **Kankar.**

Kuskite, *Spurr*, 1900.—A term applied to quartz- or adamellite-porphyry containing primary scapolite.

(Kusko R., Alaska.)

J. E. Spurr: *Am. Journ. Sci.*, x, 1900, p. 315; *U.S.G.S., 20th Ann. Rep.*, Pt. vii, 1900, p. 221.

Kvellite, *Brögger,* 1898.—A porphyritic syenite-lamprophyre containing olivine, barkevikite, lepidomelane, apatite and magnetite in a groundmass of anorthoclase laths. Cf. *Tjosite.*
(Near Lougental, Christiania District.)

Kylite, *Tyrrell,* 1912.—A melanocratic olivine-essexite with abundant labradorite, titanaugite, and olivine, and small amounts of nepheline and analcite. Cf. *Luscladite.* (Kyle district, Ayrshire.)
G. W. Tyrrell: *Geol. Mag.,* 1912, p. 121.

Kyschtymite, *Moroziewicz,* 1897.—A phanerocrystalline rock composed of anorthite, biotite, and corundum, and smaller amounts of green spinel, zircon and apatite. (Kyschtym, Urals.)
A. E. Barlow: *Geol. Surv. Canada, Mem.* 57 (Pub. No. 1022), 1915, p. 231.

L

Laanilite, *Hackman,* 1905. — A coarse-grained pegmatoid rock of which the essential constituents are garnet, biotite, quartz and iron ores.
(Laanila, Finnish Lapland.)

Labile, *Ostwald,* 1897.—A term describing the condition of a supersaturated solution in which the concentration at any given temperature is sufficiently high to ensure rapid separation of the solute, even in the absence of the solid phase.

Labradite, *Turner,* 1900.—A phanerocrystalline rock composed almost entirely of labradorite.

Labradorite, *Senft,* 1857.—As a rock name, this term is applied by French authors to leucocratic basalts rich in the mineral labradorite (Fr. *labrador*); by Russian authors it has been used for leucocratic varieties of gabbro or norite, *i.e.,* for *anorthosite.*

Laccolith, *Gilbert,* 1880. — A dome-shaped intrusion with both floor and roof concordant with the

bedding planes of the invaded formations, the roof being arched upwards as a result of the intrusion.
W. Cross: *U.S.G.S.*, *14th Ann. Rep.* (1892-3), ii, 1894, p. 165.

Lakarpite, *Törnebohm*, 1906. — A phanerocrystalline rock composed of microcline, oligoclase, and soda-amphibole; ægirine or rosenbuschite may also be present. (Korra Kärr, Sweden.)
A. E. Törnebohm: *Sveriges Geol. Unders.*, Ser. C, No. 199, 1906, p. 54.

Lamprophyre, *Gümbel*, 1887. — A general term for those facies of holocrystalline dyke-rocks which differ from the normal types containing the same essential minerals by the marked abundance of their mafic minerals, and the frequent presence of alteration products, especially calcite and those derived from the felspars; *e.g.*, *Minette* and *Kersantite*.
A. Harker: *Geol. Mag.*, 1892, p. 199.
J. S. Flett: *Trans. Roy. Soc. Edin.*, xxxix, 1900, p. 865.
J. Morrison: *Q.J.G.S.*, lxxiv, 1918-19, p. 116.

Landscape Marble.—A popular descriptive term applied to an argillaceous limestone of Liassic age, found near Bristol (Cotham stone), and characterised by the presence of conspicuous arborescent markings.
B. Thompson: *Q.J.G.S.*, l, 1894, p. 393.

Lapilli. — Volcanic ejectamenta consisting of fragments of lava of rounded or irregular shape, varying in size from that of a pea to that of a walnut.

Lassenite, *Wadsworth*, 1891. — A term proposed for fresh trachyte-glass, altered forms being termed *metabolite*. (Lassen Peak, California.)

Latent Heat.—Latent heat is the amount of heat absorbed or emitted by 1 gram of a substance at constant pressure and constant temperature during a

change of state. The various types of change are distinguished as follows :—

Latent heat of *evaporation* for the change *liquid-gas.*

Latent heat of *sublimation* for the change *solid-gas.*

Latent heat of *fusion* for the change *solid-liquid.*

Latent heat of *solution* for the change *solute-solution.*

Latent heat of *transition* for the change *solid-solid.*

Laterite, *Buchanan,* 1807. — A residual deposit, often concretionary, formed as a result of the decomposition of rocks by weathering and ground-waters, and consisting essentially of hydrated oxides of aluminium and iron, which may be crystalline or amorphous.

L. L. Fermor : *Geol. Mag.*, 1911, p. 454, p. 507, p. 559; 1915, p. 28, p. 77, p. 123.

J. M. Campbell : *Mining Mag.*, xvii, 1916, pp. 67, 120, 171, 220.

Lateritic Constituents, *Fermor,* 1911. — A term applied to the hydroxides and oxides of iron, aluminium, titanium and manganese; these, and especially the first two, being the essential constituents of *laterite.*

Lateritite, *Fermor,* 1911. — A detrital and reconstructed form of *laterite.*

Lateritoid, *Fermor,* 1911.—A lateritic rock formed by the metasomatic replacement of some other rock at its outcrop.

Latite, *Ransome,* 1898. — An andesitic rock of monzonitic composition containing orthoclase as an essential constituent in addition to plagioclase; =*trachyandesite.*

Laugenite, *Iddings,* 1913.—A general term for oligoclase-diorites. (Laugendal, Norway.)

Laurdalite, *Brögger,* 1890. — A variety of nepheline-syenite with rhombic anorthoclase and any of the

following minerals: pyroxene, amphibole and biotite; olivine-bearing varieties also occur.

(Laurdal, Norway.)

W. C. Brögger: *Eruptivgest. Kristiania*, iii, 1898, p. 7.

Laurvikite, *Brögger*, 1890.—A variety of alkali-syenite composed essentially of rhombic anorthoclase, ægirine-augite and biotite.

(Laurvik, Christiania.)

W. C. Brögger: *Zeit. f. Kryst. u. Min.*, xvi (1), 1890, p. 28.

Lavialite, *Sederholm*, 1899. — A metamorphic rock with relict phenocrysts of labradorite, probably derived from a basaltic rock or tuff. The phenocrysts are penetrated by alteration passages containing quartz, microcline, biotite and hornblende, and are set in a recrystallised amphibolite-like groundmass of those minerals, among which green hornblende is the most conspicuous.

(Kirchspiel, Lavia, Finland.)

E. Mäkinen: *Geol. För. i Stockholm Förh.*, xxxvii, 1915, p. 388.

Ledmorite, *Shand*, 1910.—An altered melanite-augite-nepheline-syenite associated with borolanite, but free from the pseudo-porphyritic character of the latter. (Ledmore River, Assynt.)

S. T. Shand: *Trans. Edin. Geol. Soc.*, ix, 1910, p. 384.

Leeuwfonteinite, *Molengraaff*, 1904. — A variety of alkali-syenite containing barkevikite, and characterised by an abundance of anorthoclase. Porphyritic varieties also occur.

(Leeuwfontein, Bushveld.)

H. A. Brouwer: *Journ. Geol.*, xxv, 1917, p. 775.

Leidleite, *Thomas & Bailey*, 1915. — A porphyritic rock containing phenocrysts of plagioclase (labradorite to anorthite) in a subviarolitic groundmass of felspar, augite, and glass. (Glen Leidle, Mull.)

E. M. Anderson & E. G. Radley: *Q.J.G.S.*, lxxi, 1915, p. 205.

Lemberg's Reaction.—A test for the discrimination of calcite and dolomite. *Lemberg's Solution*, logwood digested in an aqueous solution of aluminium

chloride, is used as a combined stain and reagent. Calcite (and aragonite) are stained violet after treatment for about ten minutes, while dolomite remains unchanged.

Lenne Porphyry, *v. Dechen.*—A group name for the keratophyres and associated crystal-tuffs of the Lenne Valley, Westphalia.

Leopardite, *Hunter,* 1853.—A variety of quartz-porphyry containing small phenocrysts of quartz in a microgranitic or microgranophyric groundmass of quartz, orthoclase, albite, and mica. The rock has a characteristically spotted or streaked appearance due to staining by hydroxides of iron and manganese.

T. L. Watson : *Journ. Geol.,* xii, 1904, p. 215.

Lepidoblastic, *Becke,* 1903.—A metamorphic texture due to the development during recrystallisation of minerals such as micas and chlorite having a flaky or scaly habit.

Leptite, *Hummel,* 1870. — A term, used especially by Swedish and Finnish geologists, applied to fine-grained granular metamorphic rocks composed mainly of quartz and felspar with subordinate mafic minerals ; = *Granulite,* = *Hälleflintgneiss.*

A. G. Högbom : *Bull. Geol. Inst. Upsala,* x, 1910, p. 42.
P. Eskola : *Bull. Comm. Géol. Finlande,* No. 40, 1914, p. 131.

Leptynite, *Haüy,* 1822.—A term applied to felspathic granulites which differ from hälleflintas in having a coarser grain.

Leptynolite, *Cordier,* 1868. — A fissile or schistose variety of *hornfels* containing mica, quartz and felspar, with or without minerals such as andalusite and cordierite. Cf. *Cornubianite.*

A. Lacroix : *Bull. Serv. Carte Géol. France,* x, 1898, p. 8.
J. S. Flett : *Mem. Geol. Surv.* (Padstow and Camelford), 1910, p. 72.

Lestiwarite, *Brögger,* 1898. — A leucocratic micro-syenite or syenite-aplite. (Lestiware, Finland.)

W. C. Brögger : *Eruptivgest. Kristiania,* iii, 1898, p. 209.

Leucite-basalt, *Zirkel,* 1870.—A basaltic rock essentially composed of leucite, pyroxene and olivine.

Leucite-phonolite.—According to Rosenbusch this is a volcanic rock whose felsic minerals are leucite and orthoclase, without nepheline. With the addition of nepheline (or nosean, etc.) the rock becomes a *leucitophyre.* It is preferable, however, to follow Zirkel, who calls the latter *leucite-phonolite,* and the former, from which nepheline is absent, *leucite-trachyte.*

Leucite Rocks.—(References)—

W. Cross: *Am. Journ. Sci.,* iv, 1897, p. 115.
H. S. Washington: *Carnegie Inst. Wash. Pub.,* 57, 1906; *Journ. Geol.,* xv, 1907, p. 257.
J. P. Iddings & E. W. Morley: *Journ. Geol.,* xxiii, 1915, p. 231.
A. Lacroix: *C.R.,* clxvi, 1917, p. 486.

Leucite-syenite. — A felspathoidal syenite containing leucite, or, more generally, pseudo-leucite, the latter consisting mainly of orthoclase and nepheline.

A. Lacroix: *C.R.,* clxv, 1917, p. 1032.

Leucite-tephrite. — A variety of tephrite containing both leucite and nepheline, or nosean, etc. Cf. *Leucotephrite.*

Leucite-trachyte, *v. Rath.*—A volcanic rock containing leucite in addition to the constituents of trachyte = *leucite phonolite* of Rosenbusch.

Leucitite.—A fine-grained or porphyritic rock, composed essentially of leucite and pyroxene; a basaltic rock with leucite instead of plagioclase, and free from olivine.

Leucitophyre, *Coquand,* 1857.—A variety of leucite-phonolite, containing leucite and nepheline, or other soda felspathoid, with generally inconspicuous felspar; the characteristic mafic constituent is ægirine or ægirine-augite.

Leuco-.—A prefix added to the names of rocks to indicate a leucocratic character. Cf. *Melano-.*

Leucocratic, *Brögger*, 1894.—A term applied to facies of igneous rocks, or to members of a series of associated rocks, which are abnormally poor in mafic (dark and heavy) minerals relative to the normal or average rock-type of the mass or series.

Leucophyre, *Gümbel.*—A variety of diabase containing saussuritised felspar, pale green and purple pyroxenes, ilmenite and abundant chlorite.

Leucotephrite, *Fouqué & Michel-Lévy*, 1879. — A term for tephrites containing leucite, but free from nepheline or other soda felspathoid. The form *leucitephrite* is preferable, as *leucotephrite* suggests a leucocratic tephrite.

Lherzite, *Lacroix*, 1917. — A holomelanocratic rock composed of brown hornblende and biotite, with a little ilmenite and occasionally garnet. The chemical composition indicates that it contains potential nepheline and leucite, and that it is a *heteromorphic form of theralite.*

(Lherz, Pyrenees.)

A. Lacroix : *C.R.*, clxv, 1917, p. 385.

Lherzolite, *De la Métherie*, 1797.—A variety of peridotite containing both monoclinic and orthorhombic pyroxenes in addition to olivine.

(Lherz, Pyrenees.)

A. Lacroix : *Nouv. Arch. du Mus. d'Hist. Nat.*, 3 Ser., vi, p. 209.

Liebenerite-porphyry.—An altered nepheline-porphyry in which the phenocrysts of nepheline have been replaced by a scaly sericitic aggregate.

(Predazzo, Tyrol.)

Lignite.—A general term applied to coal-like deposits usually of post-Carboniferous age, the most recent approaching peat and the oldest approximating to bituminous coal. Lignite is distinguished from *brown coal* by containing over 20 per cent. of water, and from ordinary coal by the fact that an

aqueous solution of potassium hydroxide is without effect on the latter, whereas it dissolves lignite in part, giving a brown solution.

Mem. Geol. Surv. Spec. Rep., Mineral Resources of Great Britain, vii, 1918.

Limburgite, *Rosenbusch,* 1872.—A rock consisting of phenocrysts of olivine and pyroxene in an alkali-rich glassy base; = *Magma-basalt,* = (chemically) *Nepheline-basalt* (with glass in place of nepheline). (Limburg, Kaiserstuhl.)

Lime-bostonite, *Brögger,* 1894. — A variety of bostonite containing a notable amount of actual or normative anorthite in the plagioclase or pyroxene respectively.

W. C. Brögger: *Q.J.G.S.,* l, 1894, p. 23.
J. V. Elsden: *Q.J.G.S.,* lxi, 1905, p. 594.

Limestone. — A general term for bedded rocks of exogenetic origin, consisting predominantly of calcium carbonate.

J. G. Goodchild: *Geol. Mag.,* 1890, p. 71.
E. W. Skeats: *Bull. Mus. Comp. Zool. Harvard,* xlii, 1903, p. 53.
E. Steidtmann: *Journ. Geol.,* xix, 1911, pp. 223, 392.
J. E. Carne & L. J. Jones: *Geol. Surv. N.S.W., Min. Res.,* No. 25.

Limurite, *Zirkel,* 1879.—A contact rock formed between granite and calcareous rocks, characterised by an abundance of axinite (over 50 per cent.), and also containing diopside, actinolite, zoisite, albite, quartz and pyrrhotite.

A. Lacroix: *C.R.,* cxv, 1892, p. 739.

Lindöite, *Brögger,* 1894. — A leucocratic variety of sölvsbergite. (Lindö Is., Christiania.)

W. C. Brögger: *Eruptivgest. Kristiania,* i, 1894, p. 133.

Linear Foliation.—A term applied to foliation which is due to the linear arrangement of lamellar and prismatic minerals such as biotite and hornblende. It is often associated with mullion or rodding structure where the foliation is itself parallel to the dip and pitch of the parallel series of folds of which

that structure is one of the outward expressions. Cf. *Mullion Structure.*

Mem. Geol. Surv. (N.W. Highlands), 1907, pp. 97-8, 245-7, and Pl. xlix, Figs. 1 & 2.

Linophyric, *C.I.P.W.*, 1906.—A term applied to porphyritic rocks in which the phenocrysts are arranged in lines or streaks.

Lion's Haunch Basalt, *Teall*, 1888.—A variety of the *Dunsapie* type (*q.v.*) of the Scottish Carboniferous basalts, characterised by the presence of glass, and sometimes of biotite and analcite, in the groundmass.

J. S. Flett: *Mem. Geol. Surv. Scot.* (Edinburgh), 1910, p. 316.

Liparite, *Roth*, 1861. — A term synonymous with *Rhyolite* (*q.v.*). (Lipari Is.)

Liquation.—A process of differentiation in which two immiscible liquids separate from their common solution (*e.g.*, from a magma). The term has also been applied to the separation of residual liquid from crystals already formed.

N. L. Bowen: *Journ. Wash. Acad. Sci.*, viii, 1918, p. 88.
F. F. Grout: *Journ. Geol.*, xxvi, 1918, p. 657.

Listwänite, *Rose.* — A schistose rock of yellowish-green colour composed of various combinations of the minerals quartz, dolomite, magnesite, talc, and limonite. (Beresowsk, Urals.)

Litchfieldite, *Bayley*, 1892.—A nepheline-syenite containing albite and dark mica, and in some varieties having cancrinite in addition to nepheline; intermediate in respect of its felspars between *mariupolite* (albite) and *foyaite* (orthoclase). (Litchfield, Mass.)

W. S. Bayley: *Bull. Geol. Soc. Am.*, iii, 1892, p. 231.
R. A. Daly: *Bull. Geol. Soc. Am.*, 1918.

Lithic Tuffs, *Pirsson*, 1915.—Volcanic tuffs, in which the most conspicuous elements are fragments of rocks. Cf. *crystal* and *vitric* tuffs.

L. V. Pirsson: *Am. Journ. Sci.*, xl, 1915, p. 191.

Lithoidal.—A term meaning "stone-like" applied to compact aphanitic materials.

Lithöidite, *v. Richthofen*, 1860. — A rhyolite without phenocrysts, made up entirely of cryptocrystalline felsitic matter.

Lithology.—The study of rocks as based on the megascopic observation of hand-specimens. In its French usage the term is synonymous with *petrography*.

Lithophysæ, *v. Richthofen,* 1860.—A term applied to hollow spherulites, often radial and concentric in structure, occurring in rhyolite, obsidian and allied rocks.

G. A. J. Cole: *Q.J.G.S.*, xli, 1885, p. 162.
F. E. Wright: *Bull. Geol. Soc. Am.*, xxvi, 1915, p. 255.

Lithosiderite, *Brezina*, 1885. — A group name for stony-iron meteorites belonging to the sub-groups of siderophyre and pallasite. Cf. *Siderolite.*

Lit-par-lit Injection.—A term used to designate the intimate penetration of bedded, schistose or other fissile formations by innumerable narrow sheets and tongues of granitic magma = *Leaf-by-leaf injection.*

T. O. Bosworth: *Q.J.G.S.*, lxvi, 1910, p. 380.

Load Metamorphism, *Daly*, 1911. — A name for a type of static metamorphism in which high temperature has been a controlling influence, as well as overhead pressure.

R. A. Daly: *Bull. Geol. Soc. Am.*, 28, 1917, p. 400.

Loam. — A detrital deposit containing nearly equal proportions of sand, silt, and clay, these terms referring to the grade-sizes of the particles. The term has generally been used in a much wider sense, the restricted definition here given having emerged during recent years as a result of grading-work for economic purposes.

Lode or **Vein.**—General terms for epigenetic mineral deposits, the form of which is characterised by

small thickness in relation to depth and length. In America the term *vein* is used in preference to *lode*.

Lodranite, *Meunier,* 1882. — A siderolitic meteorite containing crystals of olivine and bronzite in a matrix of nickel-iron.

Loess.—A widespread deposit of silt or marl extending from Central Europe through the steppes of Asia. It is a buff-coloured, porous, but coherent deposit traversed by a network of narrow tubes representing the negatives of successive generations of grass-roots. The comminution of the constituents is ascribed to the grinding action of glaciers, the fine grade and distribution to the action of wind, and the accumulation in thick deposits to the grip of vegetation.

Longulites, *Vogelsang,* 1870.—Elongated crystallites of cylindrical or conical forms considered to be formed by the adhesion of linear series of *globulites*.

F. Rutley: *Min. Mag.,* ix, 1891, p. 261.

Lopolith, *Grout,* 1918. — A large lenticular intrusive body of igneous rock, generally concordant, and differing from a sill by being centrally depressed, so that its upper surface is basin-like.

F. F. Grout: *Am. Journ. Sci.,* xlvi, 1918, p. 516.

Luciite, *Chelius,* 1892. — A fine-grained variety of diorite, composed essentially of plagioclase, hornblende, and in some varieties a little quartz. The type differs from malchite only in its coarser grain.

Lugarite, *Tyrrell,* 1912.—A porphyritic rock containing phenocrysts of titanaugite and barkevikite, with small and variable amounts of labradorite, in a base of analcite (with traces of nepheline) which makes up about half of the rock.

(Lugar, Ayrshire.)

G. W. Tyrrell: *Q.J.G.S.,* lxxii, 1917, p. 107.

Lujaurite, *Brögger,* 1890=**Lujavrite,** *Ramsay,* 1894. —A variety of nepheline-syenite, with trachytoid

texture, containing ægirine, and characterised by the conspicuous presence of eudialyte.

(Lujaur Urt, Kola.)

W. Ramsay : *Fennia,* xv, 2, p. 3.

Lundyite, *Hall,* 1914.—An intrusive rock with orthophyric texture characterised by a high percentage of alkalies and the presence of a catophorite-like amphibole. The rock has been analysed, but not described. (Lundy Is.)

Summ. Prog. Geol. Surv. (1914), 1915, pp. 53 & 56.

Luscladite, *Lacroix,* 1920.—A type of olivine-theralite or essexite characterised by the general absence of hornblende (cf. *Berondrite*), and the presence of olivine and often of biotite. Orthoclase mantles the plagioclase, and nepheline, not abundant, occurs interstitially. The Crawfordjohn essexite is a British example, and kylite is a melanocratic type.

(Ravin de Lusclade, Mont-Dore.)

A. Lacroix : *C.R.,* clxx, 1920, p. 21.

Lusitanite, *Lacroix,* 1916.—A mesocratic alkali-syenite containing riebeckite and ægirine.

(Alter Pedroso, Portugal.)

A. Lacroix : *C.R.,* clxiii, 1916, p. 279.

Luxullianite, *Pisani,* 1864.—A variety of tourmalinised granite, in which the tourmaline occurs as radiating sheaves of acicular crystals embedded in quartz. (Luxulyan, Cornwall.)

T. G. Bonney : *Min. Mag.,* i, 1877, p. 215.

J. S. Flett : *Mem. Geol. Surv.,* 347 (Bodmin and St. Austell), 1909, p. 66.

Lydite. — A siliceous rock of extremely fine grain, composed essentially of quartz and chalcedony; usually grey-black, owing to carbonaceous matter; but sometimes brown or green, due to the presence of iron hydroxides or chlorite respectively. Lydite occurs as chert-like bands in the older formations, where it represents silicified shales, limestones or tuffs. = *Lydian Stone.*

M

Macedonite, *Skeats & Summers,* 1909.—An aphanitic basaltic rock containing minute felspars, nosean, melilite, perovskite, and pseudomorphs after olivine (serpentine or chlorite) in a green vitreous or chloritic base. (Mt. Macedon, Victoria.)

E. W. Skeats: *Australian Ass. Ad. Sci.* (1909), 1910, p. 173. — *Geol. Surv. Victoria, Bull.* No. 24, 1912.

Maculose, *Holmes,* 1919. — A term suggested for a group of contact-metamorphosed rocks, including spotted "slates," knotenschiefer, and hornfels, to connote their spotted, knotted, and gnarled structures. The term may be applied to either the rocks or their structures, and serves to distinguish them from those described as *gneissose, granulose,* and *schistose,* into any of which maculose rocks and structures may pass by the continued action of more intense metamorphism. See Table on p. 280.

Madeirite, *Gagel,* 1912. — A porphyritic variety of alkali-picrite containing abundant phenocrysts of titaniferous augite and somewhat serpentinised olivine in a groundmass consisting mainly of augite and magnetite with a little plagioclase.

C. Gagel: *Zeit. Deutsch. Geol. Gess.,* lxiv, 1912, p. 399, and Pl. vii.

Madupite, *Cross,* 1897.—A fine-grained rock, consisting essentially of phenocrysts of diopside and phlogopite in a groundmass of glass having approximately the composition of leucite.

W. Cross: *Am. Journ. Sci.,* iv, 1897, p. 139.

Mænaite, *Brögger,* 1894.—A fine-grained holocrystalline rock intermediate in type between the monzonitic felsites and the dioritic lamprophyres, and characterised by an abundance of hornblende. (Mæna, South Norway.)

Mafic, *C.I.P.W.,* 1912. — A mnemonic term for the ferromagnesian and other non-felsic minerals actually present in an igneous rock, and also applied to rocks in which those minerals pre-

dominate; not synonymous with *femic*, which refers to the normative constituents of a rock calculated from its chemical analysis.
C.I.P.W. : *Journ. Geol.*, xx, 1912, p. 561.

Mafraite, *Lacroix*, 1920.—A heteromorphic form of berondrite containing soda-hornblende in large idiomorphic crystals, together with pyroxene and labradorite. The type differs from berondrite by the absence of nepheline, the constituents of that mineral being present in the amphibole.
(Mafra, Cintra, Portugal.)

Magma.—A comprehensive term for the molten fluids generated within the earth from which igneous rocks are considered to have been derived by crystallisation or other processes of consolidation. A magma includes not only the material represented by all or part of an igneous rock, but also any volatile fluxes and residual liquors which may have escaped during or after consolidation. It is therefore not correct to assume that the composition of a rock represents that of the magma from which it developed. In the case of suddenly chilled margins this may—except for gases and vapours—be nearly true, but where the rocks of an area reveal differentiation into a wide range of types, these types may represent chemically only fractions of the bulk-magma, and from the latter therefore they may differ very considerably.

Magma-basalt, *Boricky*, 1872.—A term in part synonymous with *Limburgite* (*q.v.*), but also applied to porphyritic, glassy basaltic rocks more closely related to ordinary basalt.

Magmatic Assimilation.—See **Assimilation.**

Magmatic Stoping, *Daly*, 1906.—A process whereby rock magmas are enabled to take the place previously occupied by pre-existing rocks, involving (1) marginal shattering of the rocks along the roof and walls of the magmatic chamber; and (2) sink-

ing of the blocks and fragments so produced, with concomitant occupation of the space so liberated, by lateral or upward movement of the magma.

R. A. Daly : *Ig. Rocks and their Origin,* New York, 1914, p. 194.

Magnesian Limestone.—In its petrological usage (as opposed to its stratigraphical application to a Permian formation) this term has been given to limestones containing $MgCO_3$ (about 5 to 15 per cent.), but in which dolomite cannot be detected either optically, or by the Lemberg reaction. Such rocks are thus distinguished from *Dolomitic Limestone,* in which dolomite is demonstrably present in addition to calcite. The connotation of *magnesian limestone* is, however, generally interpreted more widely, especially as a field-term.

R. C. Wallace : *Cong. Géol. Inter., C.R.* xii (1913), 1914, p. 875.

D. Woolacott : *Geol. Mag.*, 1919, pp. 452 and 485.

Magnesite Rock.—A carbonate rock consisting predominantly of the mineral magnesite.

T. Crook : *Trans. Ceramic Soc.*, 1919, p. 67.

Magnetite-högbomitite, *Gavelin*, 1917.—A rock composed of numerous crystals of grey högbomite, and occasional flakes of white hydrargillite, in a black magnetite-ilmenite matrix. Högbomite is a mineral having the composition $RO.2R_2O_3$ where RO is mainly MgO, and R_2O_3 is mainly Al_2O_3 and Fe_2O_3, together with a certain amount of TiO_2.

A. Gavelin : *Bull. Geol. Inst. Upsala,* xv, 1917, p. 310.

Magnetite-olivinite, *Sjögren*, 1876. — A variety of dunite rich in titaniferous magnetite and containing shreds of biotite. (Taberg, Sweden.)

Magnophyric, *C.I.P.W.*, 1906. — A term applied to coarsely porphyritic rocks with phenocrysts exceeding 5 mm. in one or more of their dimensions.

Malchite, *Osann*, 1892. — A term applied to rocks which have been described as micro-diorite, or

diorite-felsite, and which differ from *porphyrite* by the absence of conspicuous phenocrysts. (Odenwald.)

Mem. Geol. Surv. Scotland (Glen Coe), 1916, pp. 156, 175.

Malignite, *Lawson*, 1896.—A melanocratic variety of nepheline-syenite. (Maligne R., California.)

A. C. Lawson: *Bull. Dept. Geol. Univ. California,* Pub. 1, 1896, p. 337.

R. A. Daly: *Bull. Geol. Soc. Am.*, 1906, xvii, p. 329.

Manganolite, *Wadsworth*, 1891.—A general term proposed for rocks composed of manganese-minerals.

Mangerite, *Kolderup*, 1903.—A variety of monzonite. (Manger, near Bergen.)

C. F. Kolderup: *Bergen Mus. Aarbeit.*, No. 12, 1903, p. 107.

Manjak.—A black variety of bitumen, having a brilliant lustre and conchoidal fracture; H = about 2; S.G. = 1.06-1.07. (Barbados.)

Marble.—A general term for any calcareous or other rock of similar hardness that can be polished for decorative purposes; petrologically restricted to granular crystalline limestones, the term, when used without a mineralogical prefix, implies a variety such as statuary marble, composed almost entirely of calcite.

Marekanite.—A variety of perlitic rhyolite-glass from which large perlitic masses of clear glass readily separate. (Marekana, Okhotsk, Siberia.)

J. W. Judd: *Geol. Mag.*, 1886, p. 241.

K. Bogdanovitch: *Fundort des Marekanits,* St. Petersbourg, 1904.

Mareugite, *Lacroix*, 1917.—An even-grained theralitic rock, consisting of bytownite and hauyne with variable and sometimes considerable amounts of hornblende and augite. (Mareuge, Auvergne.)

A. Lacroix: *C.R.*, clxiv, 1917, p. 587.

Margarite, *Vogelsang*, 1872.—An aggregate of globulites, or minute sphere-like crystallites, arranged like beads in a linear series.

F. Rutley: *Min. Mag.*, ix, 1891, p. 261.

Margination Texture, *Holmquist*, 1906.—A texture due to magmatic corrosion phenomena in granites; characterised by curved and sinuous contacts between quartz and felspar, the material of later crystallisation having corroded the mineral already formed.

P. J. Holmquist: *Bull. Geol. Inst. Upsala,* vii, 1906, p. 116.

Mariupolite, *Morozewicz*, 1902.—An albite-nepheline-syenite of variable grain, containing ægirine and lepedomelane, with zircon and beckelite as notable accessories. (Mariupol, Sea of Azov.)

Markfieldite, *Hatch*, 1909. — An igneous rock composed of idiomorphic crystals of plagioclase, together with augite and/or hornblende, embedded in a groundmass of micropegmatite. The term thus denotes a dioritic granophyre, intermediate between granophyre and granodolerite.
(Markfield, Charnwood Forest.)

Markle Basalt, *Hatch*, 1892.—A type of the Scottish Carboniferous basalts; characterised by the presence of large and numerous phenocrysts of labradorite with small grains of olivine in a normal basaltic groundmass. The type differs from the *Jedburgh* type in being much more conspicuously porphyritic.

E. B. Bailey: *Mem. Geol. Surv. Scot.* (East Lothian), 1910, p. 120.
G. W. Tyrrell: *Trans. Geol. Soc. Glasgow*, xiv, 1912, p. 241.

Marl.—A general term for calcareous clay or calcareous loam.

Marloesite, *Thomas,* 1911. — A rock somewhat resembling pantellerite, containing glomero-porphyritic groups of olivine and albite-oligoclase in a felted groundmass composed largely of soda-felspar. (Marloes, Skomer Is., Pembroke.)

H. H. Thomas: *Q.J.G.S.,* lxvii, 1911, p. 175.

Marosite, *Iddings*, 1913.—A variety of shonkinite containing augite and biotite, with subordinate alkali-felspar and felspathoid. (Pic de Maros, Celebes.)
J. P. Iddings & E. W. Morley : *Journ. Geol.*, xxiii, 1915, p. 239.

Marscoite, *Harker*, 1904.—A hybrid rock, due to the partial absorption of granitic material by a gabbro magma, containing xenocrysts of quartz and felspar in a gabbroid matrix of abnormal composition. The name is intended for local use only, and not to connote a new rock-type. (Marsco, Skye.)
A. Harker : *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, pp. 175, 186.

Masanite, *Koto*, 1909.—A variety of quartz-monzonite-porphyry having phenocrysts of zoned plagioclase and corroded quartz in a finely granitic or micro-pegmatitic groundmass. (Ma-san-po, Korea.)

Masanophyre, *Koto*, 1909.—A variety of masanite in which the felspar phenocrysts consist of oligoclase mantled with orthoclase, and of which the groundmass contains blue-green hornblende, and sphene.
B. Koto : *Journ. Col. Sci., Tokyo,* xxvi, 1909, p. 189.

Mediophyric, *C.I.P.W.*, 1906. — A term applied to porphyritic rocks with phenocrysts between 5 mm. and 1 mm. in their longest dimensions.

Mediosilicic, *Clarke*, 1911.—A term suggested in place of "intermediate" to connote that the rocks so described have a silica-content falling between 52 and 66 per cent.

Megascopic.—A general term, more appropriate than *macroscopic*, applied to observations made on minerals and rocks, and to the characters observed, by means of the naked eye or pocket-lens, but not with a microscope.

Meigen's Reaction.—A test for the discrimination of calcite and aragonite. A solution of cobalt nitrate is used as a combined stain and reagent. Aragonite is stained to a lilac tint which remains visible in thin section, after boiling with the solu-

tion for about twenty minutes; calcite (and dolomite) may be stained pale blue, but appear unchanged in thin section.

Melanocratic, *Brögger*, 1894. — A term applied to rocks, or to members of a series of associated rocks, which are abnormally rich in mafic (dark and heavy) minerals relative to the normal or average rock-type of the mass or series.

Melano-, Mela-.—Prefixes added to the names of rocks to indicate a melanocratic character. Cf. *Leuco-*.

Melaphyre, *Brongniart*, 1813. — A general term for altered and amygdaloidal rocks of basaltic or andesitic types.

B. von Cotta: *Rocks Classified and Described*, trans. by P. H. Lawrence, 1878, p. 154.

Melilite-basalt, *v. Rath*, 1866. — A highly undersaturated basaltic rock essentially containing augite, melilite, and olivine. Nepheline is frequently present, and perovskite and spinellids are characteristic accessories.

A. W. Rogers & A. L. Du Toit: *Trans. S. Af. Phil. Soc.*, xv, 1904, p. 61.

G. T. Prior: *Min. Mag.*, 1903, p. 228.

Melilitite, *Lacroix*, 1896.—An igneous rock essentially composed of melilite and pyroxene. *Nepheline-* and *leucite-melilitites* are distinguished; and by the introduction of olivine the rocks become *melilite-basalts*. When the felspathoid minerals are dominant the terms *melilite-nephelinite*, or *-leucitite* may be used; and when olivine is also present, *melilite-nepheline-basalt*, or *-leucite-basalt*.

A. Lacroix: *Min. de la France*, ii, 1896, p. 501.

Merocrystalline.—=**Hemicrystalline.**

Meso-, *Grubenmann*, 1907.—A prefix used as a qualifier to the group-names suggested by Grubenmann for metamorphic rocks, to indicate that the type so distinguished belongs to the "middle zone" of metamorphism. In this zone the distinctive

physical conditions are high temperature and hydrostatic pressure and intense stress, and the rocks characteristically produced include mica-schists, garnetiferous and staurolite-schists, hornblende-schists, amphibolite and various types of crystalline limestones, quartzites and gneisses. Cf. *Epi-*, and *Kata-*.

U. Grubenmann: *Die Kristallinen Schiefer,* II, 1907, pp. 21, 172.

Mesocratic. — A term applied to facies of igneous rocks, or to members of a series of associated rocks, which are somewhat richer in mafic (dark and heavy) minerals than the normal or average rock-type of the mass or series, but not sufficiently rich to be called *melanocratic.*

Mesosiderite, *Rose,* 1864.—A general term for achondritic meteorites in which both silicate-minerals and nickel-iron are present in large proportions; = *Siderolite.*

Mesostasis. — A term applied to the ultimate interstitial material of a rock which consolidated in the final stage of solidification as a glass (*e.g.,* in intersertal basalts), a single mineral (*e.g.*, analcite, in teschenite), or a eutectic (*e.g.*, micropegmatite, in granodolerite).

Meta-.—A prefix used before the names of igneous rocks to signify that the mineral and chemical composition of the latter have been modified by alteration.

Metabasite, *Hackman,* 1907. — A general term for metamorphosed basaltic, doleritic and allied rocks, the types included ranging from diabase and epidiorite to hornblende-schist.

J. J. Sederholm: *Bull. Comm. Geol. Finlande,* No. 23, 1907, p. 92.

Metabolite, *Wadsworth,* 1891.—A term proposed for altered trachyte-glass, the fresh rock being described as *lassenite.*

Metacrystal, *Lane*, 1902.—A term applied to the large, pseudoporphyritic crystals, such as staurolite and garnet, in metamorphic rocks; = *Porphyroblast.*

A. C. Lane: *Bull. Geol. Soc. Am.*, xiv, 1902, p. 386.

Metallogeny. — The genetic study of ore-deposits in relation to age, regional tectonics, and petrographic provinces. *Metallogenic provinces* and *epochs* are recognised.

A. M. Finlayson: *Q.J.G.S.*, lxvi, 1910, p. 281.
C. Iwaski: *Journ. Col. Sci. Tokyo*, xxxii, 1912, No. 8.
W. G. Miller & C. W. Knight: *Trans. Roy. Soc. Canada*, ix, 1915, p. 241.
L. L. Fermor: *Proc. Asiatic Soc. Bengal*, xv, 1919, p. clxx.

Metamorphic Differentiation, *Stillwell*, 1918. — The segregation into definite minerals of materials which has migrated from other parts of the rocks concerned by *metamorphic diffusion* (see below).

F. L. Stillwell: *Aust. Ant. Exped. Sci. Rep. A*, iii, 1 (1) (Met. Rocks, Adelie Land), 1918, p. 72.

Metamorphic Diffusion, *Stillwell*, 1918.—The migration by diffusion of material from one part of a rock to another during its recrystallisation.

F. L. Stillwell: *Aust. Ant. Exped. Sci. Rep. A*, iii, 1 (1) 1918, (Adelie Land and critical discussion).

Metamorphic Rocks.—Rocks derived from pre-existing rocks by mineralogical, chemical, and structural alterations due to endogenetic processes; the alteration having been sufficiently complete throughout the body of the rock to have produced a well-defined new type. (For references see below, p. 156.)

Metamorphism, *Lyell*, 1833.—The sum of the thermodynamic processes of endogenetic origin which cause the transformation of a rock into a well characterised new type by more or less thorough recrystallisation, and change of texture and structure, with or without the introduction of new material. By some authors (Van Hise, Leith & Mead, *et aliter*) *metamorphism* is defined so as to

include all the changes in rocks after their crystallisation from magmas. This extreme overburdening of the term makes it synonymous with *alteration*, and thereby renders it useless. Disregarding the etymology of the word, it is expedient to restrict its significance to endogenetic alterations as defined above. A full account of the varied usage is to be found in the paper by Daly referred to below.

G. Barrow : *Q.J.G.S.*, xlix, 1893, p. 330.
F. Becke : *Cong. Geol. Inter., C.R.* ix, 1903, p. 553 (Minerals and Structures).
C. R. Van Hise : *U.S.G.S., Mon.*, 47, 1904 (General).
Mem. Geol. Surv. (N.W. Highlands), 1907.
E. S. Bastin : *Journ. Geol.*, xvii, 1909, p. 449; and xi, 1913, p. 193 (Criteria of origin).
U. Grubenmann : *Die Kristallinen Schiefer, Berlin*, 1910.
V. M. Goldschmidt : *Die Kontactmetamorphose im Kristiania-gebiet*, 1911.
Mem. Geol. Surv., 359 (Lizard), 1912.
J. D. Truemann : *Journ. Geol.*, xx, 1912, p. 236 (Criteria of origin).
L. Milch : *Journ. Geol.*, xx, 1912, p. 272.
J. Johnston & P. Niggli : *Journ. Geol.* xxi, 1913, p. 610 (Principles).
C. K. Leith & W. J. Mead : *Metamorphic Geology*, 1915.
R. A. Daly : *Bull. Geol. Soc. Am.*, xxviii, 1917, p. 375 (Classifications and Definitions).
A. Harker : *Q.J.G.S.*, lxxiv, 1918, p. lxiii (General review).
J. J. H. Teall : *Proc. Geol. Assoc.*, xxix, 1918, p. 1 (Dynamic).
W. Lindgren : *Journ. Geol.*, xxvi, 1918, p. 542 (Volume changes).
F. L. Stillwell : *Aust. Antarc. Exped. Sci. Rep.*, Vol. A, iii, 1 (1) 1918, (Adelie Land and critical discussion).
T. G. Bonney : *Geol. Mag.*, 1919, pp. 196, 246 (Foliation).

Metasomatism, *Naumann.* — The processes by which one mineral is replaced by another of different chemical composition owing to reactions set up by the introduction of material from external sources. *Metasomatic rocks* are those whose chemical composition has been substantially changed by the metasomatic alteration of its original constituents.
W. Lindgren : *Econ. Geol.*, vii, 1912, p. 521; *Journ Geol.*, xxvi, 1918, p. 543.

Metastable, *Ostwald,* 1897. — A term describing the condition of a supersaturated solution in which the presence of the solid phase is necessary to stimulate the separation of the solute.

H. A. Miers: *Trans. Chem. Soc.,* lxxxix, 1906, p. 427.

Meteorite.—A general term for mineral aggregates of cosmic origin that reach the earth by falling through the atmosphere from interplanetary space.

O. C. Farringdon: *Journ. Geol.,* ix, 1911, p. 51, etc.

G. T. Prior: *Min. Mag.,* xviii, 1916, p. 26.

Miaskite, *Rose,* 1839.—A variety of nepheline-syenite containing biotite as the chief mafic constituent. (Miask, Urals.)

Mica-schist.—A schist composed essentially of micas and quartz, the foliation being mainly due to the parallel disposition of the mica-flakes. Quartz may be granular or lenticular. Many varieties are recognised, such as those containing garnet or staurolite, in addition to the group minerals, and are distinguished by the use of prefixes specifying the chief varietal mineral.

Micro-.—A prefix commonly added—(1) to the names of megascopic textures to indicate a texture of similar type developed on a microscopic scale; *e.g.*, **microgranitic, micrographic, micropoikilitic,** etc.; (2) to the names of phanerocrystalline rocks to indicate a microcrystalline rock or groundmass of corresponding mineral composition and texture; *e.g.*, **microgranite, microdiorite, microsyenite,** etc.

Microcrystalline.—A term applied to a rock or groundmass in which the individual crystals can only be seen as such under the microscope.

Microlites. — A general term for minute crystals of tabular or prismatic habit, occurring in microcrystalline or hemicrystalline rocks and groundmasses. Microlites are distinguished from crystallites by their capacity to give a reaction with polarised light.

Microlitic Texture, *Fouqué & Michel Lévy.*—The texture of a porphyritic rock having a microcrystalline groundmass composed largely of more or less idiomorphic tabular or prismatic crystals (*e.g.*, felspar laths) with or without interstitial glass.

Micropegmatite, *Michel Lévy,* 1896. — A term for micrographic aggregates of quartz and felspar occurring as a groundmass or mesostasis in various igneous rocks.

T. H. Holland : *Q.J.G.S.,* liii, 1897, p. 405.
W. Mackie : *Trans. Edin. Geol. Soc.,* ix, 1909, p. 247.
S. J. Schofield : *Geol. Surv. Canada Mus. Bull.,* 2 (Geol. Series No. 13), 1914.
N. L. Bowen : *Journ. Geol. Supp. Vol.,* xxiii, 1915, p. 17.

Microtinite, *Lacroix* 1901.—A coarse-grained leucocratic rock of monzonitic or dioritic texture containing vitreous plagioclase (microtinite). The type occurs as *enclaves homœogènes* in lavas.

(Roc Blanc, Auvergne.)

A. Lacroix : *C.R.,* cxxxi, 1900, p. 348.

Migmatite, *Sederholm,* 1907.—A term applied to composite rocks, such as gneisses, produced by the injection of granitic magma between the foliæ of a schistose formation. Cf. *Composite gneiss.*

J. J. Sederholm : *Bull. Comm. Géol. Finlande,* 23, 1907, p. 110.

Miharaite, *Tsuboi,* 1918.—A variety of basalt characterised by abundant phenocrysts of bytownite and fewer of pyroxenes in an intersertal groundmass containing occult free silica ; = *bytownite-tholeiite.* Cf. *Cumbraite.*

(Mihara-yama, Japan.)

Seitarô Tsuboi : *Journ. Geol. Soc., Tôkyô,* xxv, 1918, p. 47.

Mijakite, *Petersen,* 1891. — A red-brown porphyritic variety of basalt, containing phenocrysts of bytownite and augite in a groundmass containing plagioclase, magnetite, manganese-pyroxene and glass. (Mijakeshima, Japan.)

Miliolite, *Carter,* 1849.—A fine-grained limestone of æolian origin occurring in Kathiawar, and con-

sisting of the tests of *Miliolina* and other foraminifera, oolitic grains, and mineral fragments, cemented by calcite.

J. W. Evans: *Q.J.G.S.*, lvi, 1900, p. 559.

Mimosite, *Cordier*, 1868. — A melanocratic dolerite rich in augite and ilmenite. Cf. *Soggendalite.*

Mineralisers. — A term applied to magmatic gases, such as hydrogen, water and compounds of fluorine, boron, sulphur, carbon, etc., and other volatile substances, which—

(1) by lowering viscosity, extending the temperature range of crystallisation, and acting as catalytic agents, are able to facilitate the crystallisation of various minerals; (2) enter into the composition of certain minerals which could not otherwise be formed; and (3) are capable of extracting and concentrating metallic and other compounds from the magma through which they were originally dispersed. = *Agents minéralisateurs.*

A. Harker: *Nat. Hist. Ig. Rocks*, 1909, p. 282.

W. H. Goodchild: *Mining Mag.*, xviii, 1917, p. 190; xix, 1918, p. 189.

Minette, *Voltz*, 1822.—A syenitic lamprophyre composed essentially of biotite and orthoclase. The term was originally and still is applied to the Jurassic ironstones of the Briey basin and Lorraine.

Minette-felsite, *Bonney & Haughton*, 1879.—A term proposed for minette-like rocks having a micro- or crypto-crystalline groundmass: *minette* proper having a finely phanerocrystalline groundmass.

T. G. Bonney: *Q.J.G.S.*, xxxv, 1879, p. 166.

Minophyric, *C.I.P.W.*, 1906. — A term applied to porphyritic rocks with phenocrysts between 1 mm. and 0.2 mm. in their longest dimensions; "phenocrysts" smaller than these are *microlites.*

"Minus" Minerals, *Lœwinson-Lessing*, 1897. — Minerals (such as garnets) whose molecular volumes are less than the sum of the molecular

volumes of the constituent oxides. In the case of allotropic modifications of the latter, the more condensed form, having the smaller molecular volume, is assumed for the calculation.

F. Lœwinson-Lessing : *Cong. Géol. Inter., C.R.* vii, 1897, p. 194.

W. H. Goodchild : *Mining Mag.*, xviii, 1917, pp. 243, 298.

Minverite, *Dewey,* 1910.—A proterobase, containing primary brown hornblende, purple-brown augite and albitised felspars ; the type differs from *albite-diabase* in the possession of primary hornblende. (St. Minver, N. Cornwall.)

H. Dewey & J. S. Flett : *Geol. Mag.*, 1911, p. 207. *Mem. Geol. Surv.*, 335-6 (Padstow), 1910, p. 46.

Missourite, *Weed & Pirsson,* 1896. — A phanerocrystalline rock, containing pyroxene, leucite, and olivine, and consequently the plutonic equivalent of a *leucite-basalt.* (Missouri.)

W. H. Weed & L. V. Pirsson : *Am. Journ. Sci.*, ii, 1896, p. 315.

Mix-Crystal.—A general term for crystals composed of two or more isomorphous or partly isomorphous constituents ; *e.g.*, plagioclase felspars ($NaAlSi_3O_8$ and $CaAl_2Si_2O_8$), hypersthene ($MgSiO_3$ and $FeSiO_3$), etc.

Mode, *C.I.P.W.*, 1902.—The actual mineral composition of a rock expressed quantitatively in percentages by weight, as opposed to the *norm* (*q.v.*).

Moldavites.—A term for the green obsidianites which occur as rolled pebbles in certain of the valleys of Bohemia. Their origin is obscure, but is almost certainly extra-terrestrial. (Moldau, Bohemia.)

F. E. Wright : *Bull. Geol. Soc. Am.*, xxvi, 1915, p. 280.

Molecular Proportion.—The figure obtained for any constituent of a rock or mineral by dividing its percentage by its molecular weight. The alternative term *Molecular Number* proposed by Washington is already applied to the sum of the atomic numbers of the atoms in a molecule of any

compound, and is therefore not suitable for the purpose intended by Washington. For tables of molecular proportions see—

C.I.P.W.: *Quantitative Classification of Igneous Rocks*, 1902.
H. S. Washington: *U.S.G.S. Prof. Pap.*, 1917.
J. F. Kemp: *Handbook of Rocks*, 1918, p. 171 *et seq.*
A. Holmes: *Petrographic Methods and Calculations*, 1920.

Molecular Volume.—The figure obtained by dividing the molecular weight of any substance by its specific gravity; = *Solid specific volume.*

W. H. Goodchild: *Mining Mag.*, xviii, 1917, pp. 243, 298; xix, 1918, p. 84.

Monchiquite, *Rosenbusch & Hunter*, 1890. — A melanocratic dyke rock, microcrystalline or porphyritic, containing abundant mafic minerals, with little or no felspar, in an isotropic base, which consists, or has the composition, of analcite. Most examples contain olivine, and nepheline- and leucite-bearing varieties are recognised. (Serra de Monchique, Portugal.)

J. W. Evans: *Q.J.G.S.*, lvii, 1901, p. 38.
Mem. Geol. Surv. Scot. (East Lothian), 1910, p. 107.
A. Holmes: *Geol. Mag.*, 1915, p. 324.

Mondhaldeite, *Graeff*, 1900. — A dyke rock of monzonitic composition containing phenocrysts of augite, hornblende, bytownite and leucite in a glassy base. (Mondhalde, Kaiserstuhl, Baden.)

Monmouthite, *Adams*, 1904. — A phanerocrystalline rock composed essentially of nepheline (about 70 per cent.) and hornblende (hastingsite) with accessory albite, cancrinite and calcite. (Monmouth Co., Ontario.)

F. D. Adams: *Am. Journ. Sci.*, xvii, 1904, p. 269.

Monotropic.—A term applied to the transition from one polymorphic form of a substance to another (*e.g.*, $MgSiO_3$ as amphibole $\rightarrow$ $MgSiO_3$ as monoclinic pyroxene) when the change can take place only in one direction. It is possible, however,

that monotropic processes may be so limited only when the action of shearing stress is left out of account.

Montrealite, *Adams*, 1913. — A highly melanocratic variety of olivine-essexite. (Montreal.)

F. D. Adams: *Cong. Geol. Inter., C.R.* xii, *Guide*, 3, 1913, p. 39.

Monzonite, *de Lapparent*, 1864.—A phanerocrystalline rock, having approximately equal quantities of orthoclase and plagioclase, so that the rock is intermediate between syenite and diorite, or syenite and gabbro. It is desirable that the plagioclase should be at least as calcic as labradorite, and that rocks intermediate between syenite and diorite should be distinguished as *syenodiorite*, *monzodiorite* or *orthoclase-diorite*.

(Monzoni, Tyrol.)

W. C. Brögger: *Eruptivgest. Kristiania*, ii, 1895, p. 6.

Monzonitic Texture.—A texture characterised by the idiomorphism of plagioclase crystals with orthoclase occupying part of the interstitial spaces.

Mortar Structure.—A mechanical structure in which small grains produced by granulation occupy the cracks or interstices between larger individuals.

Mosaic Texture.—A granulose texture of metamorphic rocks in which the individual grains meet with nearly straight or but slightly curved contacts; = *Granoblastic*.

Mud Cracks.—A general term for the irregular desiccation fractures, crudely simulating a series of polygons, formed in the superficial layers of a deposit of mud exposed to the atmosphere.

E. M. Kindle: *Journ. Geol.*, xxv, 1917, p. 135.

Mudstone.—An indurated non-laminated sediment composed of clay-minerals and other constituents of the mud grade. Cf. *Shale*.

Mugearite, *Harker*, 1904. — A dark finely-crystalline rock of trachytic to basaltic aspect, distinguished from basalt by the occurrence of oligoclase and orthoclase in place of labradorite, by generally con-

taining olivine in greater amount than augite, and by the possession of a trachytic rather than a basaltic texture. (Mugeary, Skye.)

A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, p. 265.

J. S. Flett: *Summ. Prog. Geol. Surv.* for 1907, 1908, p. 119.

Mullion Structure, *Kinahan*, 1891.—A structure first observed in the folded metamorphic rocks of Donegal, recalling the appearance of the clustered columns which support the arches, or divide the lights of mullioned windows, in Gothic churches. The structure is also described as *Rodding Structure*, and is typically displayed in the Eirebol district, where "rods" of white quartz, varying in dimensions from those of telegraph poles to those of walking sticks, lie parallel to each other down the dip slope of the Moine schists. Where minerals of elongated habit like hornblende and biotite are present in the rocks showing mullion or rodding structure the crystals are arranged parallel to each other and to the dip and pitch of the folds. Cf. *Linear Foliation.*

Mem. Geol. Surv. (N.W. Highlands), 1907, pp. 97-8, 245-7, and Pl. xxv, facing p. 200.

See also *Geol. Mag.*, 1871, p. 559, fig. 2, where mullion structure is wrongly described as "ice-fluting."

Multiple (Intrusions).—A term applied to sills, dykes, laccoliths and other intrusions, formed by two or more successive injections of approximately the same magma.

Muniongite, *David et aliter*, 1901. — A variety of tinguaite, containing about 44 per cent. of alkali-felspar, 36 per cent. of nepheline and 20 per cent. of ægirine-augite. (Kosciusko, N.S.W.)

T. E. W. David (*et aliter*): *Proc. Roy. Soc., N.S.W.*, xxxv, 1901, p. 366.

Murasakite, *Koto*, 1887.—A schistose rock composed essentially of piedmontite and quartz. (Murasako, Japan.)

B. Koto: *Journ. Coll. Sci. Univ. Japan*, i, 1887, p. 303; ii, 1888, p. 94.

Murbruk Structure.—See **Mortar Structure.**

Muscovadite, *Winchell,* 1900. — An endomorphic variety of norite characterised by the presence of cordierite and biotite.

A. N. Winchell: *Amer. Geol.*, xxvi, 1900, p. 294.

Mylonite, *Lapworth* 1885. — A compact chert-like rock, without cleavage, but with a streaky or banded structure; produced by the extreme granulation and shearing of rocks which have been pulverised and rolled out during overthrusting, or by the action of dynamic metamorphism generally.

P. Quensel: *Bull. Geol. Inst. Upsala,* xv, 1916, p. 91.

J. J. H. Teall: *Proc. Geol. Assoc.*, xxix, 1918, p. 2 and Plate 1.

Mylonite-gneiss, *Quensel,* 1916.—A rock partly granulated and partly recrystallised, intermediate in its characters between mylonite and schist. The felsic minerals show cataclastic phenomena without much recrystallisation, and often occur in aggregates as "augen" surrounded by and alternating with schistose streaks and lenticles of the recrystallised dark or mafic minerals; = *Augenschist.*

P. Quensel: *Bull. Geol. Inst. Upsala,* xv, 1916, p. 101.

Myrmekite, *Sederholm,* 1899. — An intergrowth of plagioclase and vermicular quartz, generally replacing potash felspars, formed during the later or paulopost stages of consolidation, or during a subsequent period of plutonic activity.

J. J. Sederholm: *Bull. Comm. Géol. Finlande,* No. 48, 1916, p. 63.

N

Nakhlite.—An achondritic meteoritic stone consisting of a holocrystalline aggregate of diopside, and olivine, with a little interstitial oligoclase, augite and magnetite.

G. T. Prior: *Min. Mag.*, xvi, 1912, p. 274.

Napoleonite.—See **Corsite.**

Naujaite, *Ussing,* 1911.—A variety of nepheline-sodalite-syenite rich in sodalite, and also containing microcline and small amounts of albite, analcite, ægirine and soda-amphiboles; characterised by a peculiar poikilitic texture.
(Naujakasik, Illimausak, S. Greenland.)
N. V. Ussing: *Medd. om Grönland,* xxxviii, 1911, p. 154.

Navite, *Rosenbusch,* 1887.—A porphyritic variety of olivine-dolerite, containing abundant phenocrysts of serpentinised olivine, with fewer of augite and labradorite, in a holocrystalline doleritic groundmass. (Nave, Nahe Valley, Prussia.)

Neck.—A vertical plug-like body of igneous rock or volcanic ejectamenta, or both, representing the feeding channel of a volcano. = *Vent.*

Nelsonite, *Watson,* 1907. — A dyke rock composed essentially of ilmenite and apatite, and generally containing rutile. (Nelson, Virginia.)
T. L. Watson & S. Taber: *Bull. Geol. Surv. Virginia,* iii, A, 1913.

Nematoblastic, *Becke,* 1903.—A metamorphic texture due to the development during recrystallisation of minerals like sillimanite, having a fibrous habit.

Nepheline-basalt, *Gerard,* 1841. — An undersaturated basaltic rock essentially containing nepheline, pyroxene, and olivine, with little or no felspar.

Nepheline-syenite. — A phanerocrystalline igneous rock generally of granular or trachytoid texture, composed essentially of alkali-felspars, nepheline, and mafic minerals. The latter usually, but not necessarily, include soda-pyroxenes and amphiboles; other soda-felspathoids may be present in addition to nepheline, and accessory minerals such as zircon, sphene, apatite and others of rarer occurrence, are often more than usually abundant.
A. Lacroix: *Nouv. Arch., Mus. d'Hist. Nat.,* iv, 1902, p. 178.
F. D. Adams & A. E. Barlow: *Mem. Geol. Surv. Canada,* No. 6 (Pub. 1082), 1910, p. 227.
P. Quensel: *Bull. Geol. Inst. Upsala,* xii, 1913, p. 163.

Nephelinite, *Cordier*, 1868. — An aphanitic or porphyritic rock composed essentially of augite and nepheline, olivine being absent. If the latter mineral be present the rock is termed *nepheline-basalt.*

Nephelinitoid Phonolite.—A general term for phonolites in which felspathoids are more abundant than felspars.

Nevadite, *v. Richthofen*, 1868.—A porphyritic variety of rhyolite rich in phenocrysts. (Nevada.)

Newlandite, *Bonney*, 1899. — A variety of griquaite composed of garnet, enstatite, and chrome-diopside. (Newlands Diamond Pipe, S. Africa.)
T. G. Bonney : *Nat. Sci.*, xv, 1899, p. 177.

Nodule. — A general term for concretionary bodies, which can be separated as discrete masses from the formation in which they occur.
G. F. Becker : *U.S.G.S., Mon.* xiii, 1888, p. 64.

Nonesite, *Lepsius*, 1878. — A variety of porphyritic basalt characterised by phenocrysts of labradorite, augite, and enstatite, in a groundmass of plagioclase and augite. (Near Mte. Cevelino, Tyrol.)

Non-graded Sediments.—A general term for detrital sediments, loose or cemented, containing notable amounts of more than one grade; *e.g.*, *loam*, *boulder-clay.*

Non-uniform Pressure.—See **Directed Pressure.**
J. Johnston & P. Niggli : *Journ. Geol.*, xxi, 1913, p. 599.
J. Johnston : *Journ. Geol.*, xxiii, 1915, p. 732.

Nordmarkite, *Brögger*, 1890. — A quartz-bearing alkali-syenite, the type-rock containing biotite and ægirine as the chief coloured minerals.
(Nordmarken, Norway.)
W. C. Brögger : *Zeit. f. Kryst.*, xvi (1), 1890, p. 54.

Norite, *Esmark.* — A phanerocrystalline rock composed essentially of labradorite and orthorhombic pyroxene; if augite be present in addition the

rock may be called either *hyperite*, or *hypersthene-gabbro*, according as hypersthene or augite is the dominant pyroxene.

J. H. L. Vogt : *Q.J.G.S.*, 1909, p. 81.
G. S. Rogers : *Ann. New York Acad. Sci.*, xxi, 1911, p. 29.
A. E. V. Zealley : *Trans. Roy. Soc. S. Af.*, v, 1915, p. 1.

Norm, *C.I.P.W.*, 1902.—A term applied to the chemical composition of an igneous rock expressed in terms of standard "normative" mineral molecules calculated from the composition as stated in terms of oxides; contrasted with the *Mode*, which is the actual mineral composition, stated quantitatively.

C.I.P.W. : *The Quantitative Classification of Igneous Rocks*, 1903.

Normative or **Standard Minerals,** *C.I.P.W.*, 1902.—A series of ideal mineral-compounds in terms of which the composition of a rock may be expressed by a suitable manipulation of the analysis as stated in oxides, etc. The minerals are divided into salic and femic groups, and are chosen to afford a simple standard for comparison, complex minerals such as the aluminous ferromagnesian minerals being excluded.

Northfieldite, *Emerson*, 1915. — An ultra-quartzose granite containing 83 per cent. of quartz and 13 per cent. of soda-orthoclase. (Northfield, Mass.)

B. K. Emerson : *Am. Journ. Sci.*, xl, 1915, p. 215.

Noseanite, *Boricky*, 1873.—A variety of felspathoid basalt rich in nosean, and free from felspar and olivine.

Nosean-phonolite, *Boricky*, 1873. — A variety of phonolite containing nosean (*e.g.*, that of the Wolf Rock, Cornwall).

J. J. H. Teall : *Brit. Pet.*, 1888, p. 367.

Novaculite, *Cordier*, 1868. — An aphanitic granulose or cryptocrystalline rock essentially composed of quartz, sometimes containing other forms of

silica, and generally accessory felspar and garnet; used as *whetstone* or *honestone*.

E. F. Davis: *Bull. Dept. Geol. Univ. California*, xi, p. 333, 1918.

O

Obsidian.—A volcanic glass, generally black, banded, or microspherulitic, with a glassy or satiny lustre and conchoidal fracture.

F. E. Wright: *Bull. Geol. Soc. Am.*, xxvi, 1915, p. 255.

Obsidianite, *Walcott*, 1898.—A term applied to small balls, buttons, and spheroidal and dumb-bell forms of dark green to black glass, often pitted and furrowed; approximating in composition to obsidian, but having generally a smaller percentage of alkalies. Their origin is unknown, but is probably cosmic, as they occur in Australia and elsewhere as discrete bodies often hundreds of miles from any possible volcanic source. Cf. *Australite*, *Billitonite*, *Moldavite*.

R. H. Walcott: *Proc. Roy. Soc. Victoria*, xi, 1898, p. 23.
E. J. Dunn: *Geol. Surv. Victoria, Bull.* 27, 1912.
H. S. Summers: *Proc. Roy. Soc. Victoria*, xxi, 1909, p. 423; see also p. 444.

Occult Minerals. *Iddings*, 1913. — A term applied to minerals which are deduced from chemical considerations to be actually or potentially present in a holocrystalline igneous rock, but which for various reasons cannot be recognised individually. Thus the detection of K_2O in a basalt suggests the presence of orthoclase, which may occur in crystals too small for determination, or may be held in solid solution by plagioclase.

J. P. Iddings: *Igneous Rocks*, II, 1913, p. 19.

Ocellar Texture. *Rosenbusch*, 1887.—A texture due to the tangential disposition of minerals such as biotite, or pyroxene, around the borders of idiomorphic crystals of later growth, such as analcite or leucite.

Octahedrite. — A group name for iron meteorites, which, on being etched, develop the Widtmanstätten lines, due to the presence of kamasite and taenite parallel to the octahedral faces.

Odinite, *Chelius*, 1892. — A porphyritic dyke rock of basaltic composition, containing phenocrysts of labradorite and augite in a groundmass composed of felspar laths and needles of hornblende. (Odenwald.)

Oikocryst, *C.I.P.W.*, 1906.—A matrix or host crystal through which smaller crystals (*chadacrysts*) of other minerals are scattered as poikilitic inclusions.

Oil Shale.—A fine black or dark-brown shale containing *kerogen* (*i.e.*, material from which crude petroleum can be obtained by distillation) and characterised by having a brown streak, a leathery appearance with parting-planes often smooth and polished, and a minutely-laminated structure. It differs from carbonaceous shale by curling when it is cut, and by its toughness and resistance to disintegration by weathering.

Mem. Geol. Surv. Scot. (Oil Shales of the Lothians), 2nd Ed., 1912.

H. R. J. Conacher: *Trans. Geol. Soc. Glasgow*, xv, 1917, p. 164.

Geol. Surv. Spec. Rep. Mineral Resources of Great Britain, vii, 1918.

Oje Diabase, *Törnebohm.*—A type of porphyritic dolerite containing long plagioclase laths in an aphanitic basaltic groundmass.

Oligoclasite, *Bombicci*, 1868.—A variety of granular olivine-norite which has suffered a certain amount of alteration. The plagioclase is labradorite in part, generally saussuritised, and reduced to oligoclase with complementary secondary products. Hypersthene and olivine, with hornblende, chlorite, and bastite, as alteration products, are the characteristic mafic minerals. By recent authors the name *oligoclasite* has been given to phanero-

crystalline leucocratic rocks composed chiefly of oligoclase, and it is in this more general sense that the term is now used.

Oligosite, *Turner*, 1900. — A phanerocrystalline rock composed almost entirely of oligoclase.

Olivine-.—As a mineral qualifier this name is added to the names of many igneous rocks, to distinguish olivine-bearing types from those free from that mineral, *e.g., Olivine-basalt, olivine-theralite,* etc.

Olivine-leucitite.—= *Leucite Basalt.*

Olivine-nephelinite.—=*Nepheline Basalt.*

Olivine Rock.—= *Dunite.*

Olivinite, *Eichstadt*, 1887.—A variety of hornblende-picrite containing augite and anorthite.

Ollenite, *Cossa,* 1881.—A term applied to a variety of hornblende-schist characterised by abundant epidote, sphene, and rutile, with smaller amounts of garnet and other accessories.

(Col d'Ollen, Piedmont.)

Onkilonite, *Backlund*, 1915.—A variety of felspathoid-basalt consisting of nepheline, augite, olivine, and perovskite, with small amounts of leucite and interstitial glass; felspars and iron-ores are absent.

(Is. of New Siberia.)

H. G. Backlund: *Bull. Acad. Sci. St. Petersbourg*, 1915.

Onyx Marble. — A term applied to compact banded varieties of calcareous tufa, capable of taking a polish.

G. P. Merrill: *Rep. U.S. Nat. Museum,* for 1893, p. 593.

Oolite.—A rock made up of spheroidal or ellipsoidal grains formed by the deposition of successive coats of calcium carbonate around a nucleus.

J. J. H. Teall: *Mem. Geol. Surv.* (Jurassic Rocks Britain), Vol. iv, 1894.

F. M. Van Tuyl: *Journ. Geol.*, xxiv, 1916, p. 792.

W. H. Bucher: *Journ. Geol.*, xxvi, 1918, p. 593.

Ooze.—A soft incoherent deep-sea deposit composed almost wholly of the shells and débris of foraminifera, diatoms, and other organisms. Cf. *Globigerina Ooze, Radiolarian Ooze,* etc.

Opacite, *Vogelsang*, 1872.—A non-committal descriptive term suggested to avoid periphrasis, for black opaque grains and scales which may be iron-ores, or carbonaceous matter, but which are in general too small for individual determination by optical methods.

For microchemical tests see A. Brammall: *Geol. Mag.*, 1920, p. 123.

Ophicalcite, *Brongniart*, 1813.—A variety of crystalline limestone composed of calcite and serpentine.

Ophite, *Palassou*, 1819. — A general term applied to the ophitic diabases (dolerites with uralitised pyroxenes) occurring in the Pyrenees.

A. Lacroix: *C.R.*, clxv, 1917, p. 293.

Ophitic Texture, *Michel-Lévy*, 1877. — A texture characteristic of dolerites, due to the penetration of pyroxene crystals by laths of plagioclase. A similar texture is sometimes developed between other pairs of minerals. When the pyroxene crystals wholly enclose a number of plagioclase laths, the texture becomes a variety of *poikilitic* texture, and is distinguished by the term *poikilophitic*.

A. N. Winchell: *Bull. Geol. Soc. Am.*, xx, 1910, p. 661.

Orbicular Structure, *Delesse*, 1849. — A structure developed in certain phanerocrystalline igneous rocks (*e.g.*, granites, diorites, and corsite), due to the occurrence of concentric shells of different mineral composition, around centres that may or may not exhibit a xenolithic nucleus; = *spheroidal, = nodular.*

A. C. Lawson: *Bull. Dept. Geol. Univ. California*, Pub. 3, 1904, p. 383.

G. A. J. Cole: *Sci. Proc. Roy. Dublin Soc.*, xv, 1916, p. 141.

Orbite, *Chelius*, 1892. — A variety of hornblende-porphyrite containing phenocrysts of hornblende in a groundmass composed essentially of laths of plagioclase. (Orbishöhe, Odenwald.)

Ordanchite, *Lacroix*, 1917. — A variety of hauyne-tephrite containing phenocrysts of andesine and orthoclase. (Banne d'Ordanche, Auvergne.)

A. Lacroix: *C.R.*, clxiv, 1917, p. 582.

Order, *C.I.P.W.*, 1902.—A division of igneous rocks, considered after the division into classes, based (in classes I., II. and III.) on the relative proportions of normative quartz *or* nepheline to the sum of the normative felspars. This division is analogous to the division of rocks into *oversaturated*, *saturated* and (as regards felspathoids) *undersaturated* types. In classes IV. and V. the orders are based on the relative proportions of the normative pyroxenes, and olivine, etc., to the sum of the normative iron-ores and titanium minerals.

Order of Crystallisation.—A phrase loosely employed for the order in which the minerals of an igneous rock *ceased* to crystallise, and determined by such textural features as the idiomorphism of one mineral to another, and the indentation or enclosure of one mineral by another. Such features rarely provide evidence of the order in which the minerals *began* to crystallise.

N. L. Bowen: *Journ. Geol.*, xx, 1912, p. 457.
W. Mackie: *Trans. Edin. Geol. Soc.*, ix, 1909, p. 247.

Ore-deposits.—A general term applied to rocks containing metalliferous minerals of economic value in such amount that they can be profitably exploited. By a double analogy the term is generally extended to include economically valuable rocks containing certain non-metalliferous minerals, such as graphite and diamond; and also to deposits which, though they may not be immediately capable of profitable exploitation, may yet become so by a change in the economic circumstances that control their value.

Orendite, *Cross*, 1897. — A phanerocrystalline rock composed of leucite and sanidine, with phlogopite and augite, and therefore a plutonic equivalent of leucite-trachyte.

W. Cross: *Am. Journ. Sci.*, iv, 1897, p. 123.

Organogenous, *Renevier,* 1880.—A group name applied to rocks of organic origin.

Ornöite, *Cederström,* 1893. — A term applied to a variety of hornblende-diorite, the chief member of a suite of rocks in which the felspar varies from oligoclase to labradorite as the proportion of hornblende increases. The rock thus passes into hornblende-gabbro, and by decrease of felspar into hornblende-picrite. (Ornö, Sweden.)

Orthoclase-gabbro, *Pumpelly,* 1880. — A descriptive name for rocks now known as *monzonite,* in which the plagioclase is at least as calcic as labradorite; = *Gabbro-syenite.* Cf. *Granogabbro.*

Orthoclasite, *Merwin,* 1915.—A medium to fine-grained dyke-rock containing about 90 per cent. or more of orthoclase.
U.S.G.S., Prof. Pap. 87, 1915, p. 40.

Orthofelsite, *Teall,* 1888.—A rock containing porphyritic orthoclase in a felsitic groundmass, phenocrysts of quartz being absent; = *Orthophyre.*
J. J. H. Teall: *British Petrography,* 1888, p. 291.

Orthogneiss, *Rosenbusch,* 1898.—A general term applied to gneisses derived from rocks of igneous origin; contrasted with *paragneiss* (*q.v.*).

Orthophyre, *Coquand,* 1851. — = *Orthoclase Porphyry.*

Orthophyric Texture, *Rosenbusch,* 1896.—A groundmass texture distinguished from trachytic texture by the presence of abundant stumpy rectangles of felspar.

Orthosite, *Turner,* 1900.—A hololeucocratic phanerocrystalline rock composed almost entirely of orthoclase.

Ortlerite, *Stache & John,* 1879.—A variety of hornblende-porphyrite containing phenocrysts of hornblende in a holocrystalline felspathic groundmass. (Mte. Confinale, Tyrol.)

Ossypite, *Hitchcock,* 1871.—A coarse-grained variety of troctolite composed of labradorite, olivine, and magnetite, with a little diallage.
(Waterville, New Hampshire.)

Ostraite, *Duparc,* 1913. — A variety of ariégite characterised by abundant magnetite and spinel.
(Ostraia Sopka, Urals.)
L. Duparc: *Bull. Soc. franç. Min.,* xxxvi, 1913, p. 1.

Ottajanite, *Lacroix,* 1917. — A variety of leucite-tephrite richer in plagioclase and poorer in leucite than vesuvite. Corresponds in chemical composition to *sommaite.* (Ottajano, Mte. Somma.)
A. Lacroix: *C.R.,* clxv, 1917, p. 485.

Ottrelite-schist. — A schistose rock characterised by abundant porphyroblastic or embryo-crystals of ottrelite. (Ottrez, Ardennes.)

Ouachitite, *Kemp,* 1890. — An olivine-free variety of monchiquite characterised by abundant biotite.
G. H. Williams: *Geol. Surv. Arkansas Ann. Rep.,* ii, 1890, p. 107.

Ouenite, *Lacroix,* 1911. — A fine-grained eucrite-like rock containing green augite and anorthite with smaller quantities of hypersthene and olivine. Both melanocratic and leucocratic varieties occur.
(Ouen, New Caledonia.)
A. Lacroix: *C.R.,* clii, 1911, p. 816.

Oversaturated, *Shand,* 1915. — A term applied to igneous rocks which contain free silica (quartz, tridymite, etc.) of magmatic origin.
S. J. Shand: *Geol. Mag.,* 1913, p. 508.
A. Holmes: *Geol. Mag.,* 1917, p. 119.

Oxygen Ratio, *Bischof.* — The figure expressing the following ratio, calculated from the molecular proportions of the constituents of a mineral or rock—

$$\frac{\textit{Number of atoms of oxygen in the basic oxides.}}{\textit{Number of atoms of oxygen in } SiO_2.}$$

Cf. *Coefficient of Acidity.*

Ozokerite.—A compact, waxy, natural hydrocarbon of various colours, but generally jet-black; soluble in turpentine and chloroform = *mineral wax* = *native paraffin*. (Galicia.)

P

Pacific Suite, *Harker,* 1896.—A general term for the whole assemblage of calc-alkali-rocks, notably represented by andesites, granodiorites, and associated rocks; directing attention to their distribution around the Pacific, to their association with Pacific types of coast-line, and more generally to their association with tectonic structures of the mountain-building type due to compression, folding, and overthrusting. Cf. *Atlantic Suite.*

Pahoehoe, *Dutton,* 1883.—An Hawaiian term for fluent or ropy lava consisting of wrinkled, corded, hummocky flows free from the jagged and scoriaceous masses characteristic of block-lava; = *Dermolithic lava.* Cf. *Aa-lava.*

Paisanite, *Osann,* 1893.— = *riebeckite-microgranite;* = *riebeckite-quartz-keratophyre;* = *ailsyte.* (Paisano Pass, Texas.)

Palagonite, *Waltershausen,* 1853.—A term applied to altered basaltic glass, occurring interstitially, as amygdale fillings, or in tuffs. Palagonite is a soft, brown or greenish-black cryptocrystalline substance. (Palagonia, Sicily.)

J. J. H. Teall: *Q.J.G.S.,* liii, 1897, p. 485.

Palatinite, *Laspeyres,* 1869.—A term applied to basaltic and dioritic rocks containing orthorhombic pyroxenes.

Palæo-.—A prefix, used particularly by Continental authors, to indicate the pre-Tertiary age, and generally altered character, of the rock to the name of which is added; *e.g.*, *palæopicrite.* By some writers the term *palæo* has been further restricted

to pre-Carboniferous rocks, those of pre-Tertiary and post-Devonian age being indicated by the prefix *meso-*.

Paleotypal, *Brögger,* 1894.—A general term applied to aphanitic and porphyritic igneous rocks having the *habit* or suite of characteristics typical of altered volcanic and hypabyssal rocks such as many of those of pre-Tertiary age. By decomposition felspars have lost their original lustre, and glass, where present, has become dull through devitrification. Rocks having the younger-looking aspect of fresh volcanic rocks are described as *cenotypal* (*q.v.*).

Palimpsest Structure, *Sederholm.* — A structure of metamorphic rocks due to the presence of remnants of the original texture of the rock.

Palingenesis, *Sederholm,* 1907. — The rebirth of a magma *in situ* by the fusion of pre-existing rocks such as granites, gneisses and schists.

J. J. Sederholm : *Bull. Comm. Géol. Finlande,* 23, 1907, p. 102.

Pallasite, *Rose,* 1862.—A group name for siderolites, containing fractured or rounded crystals of olivine in a network of nickel-iron.

Pan-idiomorphic, *Rosenbusch.*—A textural term applied to rocks in which almost all the constituents are idiomorphic.

Pantellerite, *Förster,* 1881. — An alkali-rhyolite or quartz-soda-trachyte (according to the abundance of quartz), containing anorthoclase, ægirine and cossyrite. (Pantelleria, Mediterranean.)

H. S. Washington : *Journ. Geol.,* xxi, 1913, p. 653, p. 683; xxii, 1914, p. 16.

Paragenesis. — A term connoting the association of minerals in characteristic suites considered in relation to their origin, and implying a deduction of the processes by which each suite has developed, or of the order of formation or alteration of the minerals present in the suite.

Paragneiss, *Rosenbusch,* 1901. — A term applied to gneisses formed from detrital sediments such as arkose; contrasted with *orthogneiss* (*q.v.*).

Paramagnetism, *Faraday,* 1845.—A property of many substances, akin to ferromagnetism, in virtue of which, when placed in a non-uniform magnetic field, they tend to move towards the strongest part. Permanent magnetism is practically absent, and the susceptibility, which is far smaller than that of iron, is constant at any given temperature, but is in most substances nearly inversely proportional to the absolute temperature. Cf. *diamagnetism.*

For the application of the magnetic properties of minerals to their separation see

T. Crook: *Science Progress,* No. 5, 1907, p. 30.

Paulopost, *Evans,* 1916.—A general term applied to changes suffered by igneous rocks immediately after their formation, the changes being a direct consequence of the consolidation of the magma (*e.g.*, albitisation, serpentinisation); = *Penecontemporaneous* = *Deuteric.*

Peach.—A local Cornish name for rocks produced by the alteration of the walls of tin-lodes, and consisting of quartz with chlorite or tourmaline.

Pegmatite, *Haüy,* 1822.—A term applied to graphic-granite, and extended to coarse-grained modifications of granite characterised by irregular segregation of particular minerals rather than by interpenetration. The term has also been applied to other igneous rocks whose names are used as a prefix, *e.g., syenite-pegmatite.*

W. O. Crosby & M. L. Fuller: *Technology Quarterly,* ix, 1896, p. 326.

J. V. Elsden: *Geol. Mag.,* 1904, p. 308.

L. Duparc: *Mem. Soc. Phys. et d'Hist. Nat. Geneva,* xxxvi, Pt. 3, 1910, p. 283.

E. S. Bastin: *Journ. Geol.,* xviii, 1910, p. 297.

— *U.S.G.S. Bull.* 445, 1911.

F. F. Grout: *Econ. Geol.,* xiii, 1918, p. 185.

Pegmatoid, *Evans*, 1912.—A term suggested to denote very coarse-grained facies of igneous rock having a pegmatite-habit, but differing from pegmatite proper by the absence of graphic texture.

Pelagite.—A term applied to the manganese nodules and concretions of deep-sea deposits; = *Halobolite*.
"*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 341.

Pelite, *Naumann*. — A general term for clastic sediments composed of clay, minute particles of quartz, or rock-flour. A volcanic ash of corresponding grade is called *pelitic tuff*.

Pencatite. — A crystalline limestone containing brucite; calcite and brucite being in approximately equal molecular proportions (63 per cent. and 37 per cent. respectively). Cf. *Predazzite*.
A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, p. 150.

Peperino.—A local Italian name for a soft incoherent yellow-grey tuff, containing broken crystals of felspar, leucite, biotite, and augite, and numerous rock-fragments embedded in a finely-granular base.

Per-, *C.I.P.W.*, 1902.—A prefix indicating that one factor is present in extreme amount, its ratio to another factor being greater than 7/1; *e.g.*, *peralcalic*, *persalic*, etc.

Peridotite, *Rosenbusch*, 1877. — A general term for non-felspathic phanerocrystalline rocks, consisting of olivine, with or without other mafic minerals. Spinellids are the usual accessories.
J. W. Judd: *Q.J.G.S.*, xli, 1885, p. 354.
A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904, pp. 63 and 374.
— *Mem. Geol. Surv. Scot.* (Small Isles), 1908, p. 79.

Perknite, *Turner*, 1901. — A general term for rocks composed essentially of pyroxenes or amphiboles, or of members of both groups.
H. W. Turner: *Journ. Geol.*, ix, 1901, p. 507.

Perlite.—A glassy volcanic rock of rhyolitic composition with marked perlitic structure.
W. W. Watts: *Q.J.G.S.*, l, 1894, p. 367.

Perlitic Structure. — A structure produced in homogeneous material by contraction during cooling, and consisting of a system of irregular, convolute, and spheroidal cracks; generally confined to natural glass, but sometimes found in quartz, and other non-cleavable minerals, and as a relict structure in devitrified rocks.
W. W. Watts: *Geol. Mag.*, 1894, p. 379.

Permanent Set.—The permanent change of shape of a *plastic* substance due to its imperfection of elasticity, *i.e.*, to the incompleteness of its recovery after being stressed.

Persilicic, *Clarke*, 1911. — A term suggested to replace the term *acid* as applied to igneous rocks; for *intermediate* and *basic* the corresponding terms are *mediosilicic* and *subsilicic*, respectively.

Petrogenesis. — A branch of Petrology which deals with the origins of rocks, and more particularly with the origins of igneous rocks.
J. P. Iddings: *Bull. Phil. Soc. Wash.*, xii, 1892, p. 89.
C. Doelter: *Die Petrogenesis*, 1906.
J. P. Iddings: *Proc. Am. Phil. Soc.*, l, 1911, p. 286.
A. Harker: *Brit. Ass. Rep.* (1911), 1912, p. 370.
R. A. Daly: *Igneous Rocks and their Origin*, 1914.
A. Harker: *Q.J.G.S.*, lxxiii, 1917, p. lxvii.
A. Holmes: *Geol. Mag.*, 1916, p. 268.
— *Q.J.G.S.*, lxxii, 1916, p. 271: and lxxiv, 1918, pp. 51 and 63.

Petrographical Province, *Judd*, 1886.—A natural region in which the rocks belonging to a definite cycle of igneous activity are characterised by specific peculiarities, collectively as well as individually, which distinguish them from other assemblages of rocks belonging to other regions or cycles. The possession by the rocks of certain common or related features as regards chemical and mineral composition, structure and texture, mode of oc-

currence, alterations, associated ore-deposits, and attendant metamorphic phenomena, is interpreted to imply community of origin and similarity of evolution. In any given Petrographical Province a similar succession of processes, dependent on the preceding geological history of the region, is considered to have acted on similar suites of the raw materials from which the related igneous rocks were evolved. Thus there is necessarily some overlapping of adjacent Provinces both in space and time, and it is rarely that a Province as a whole can be clearly defined in terms of well-marked boundaries. = *Comagmatic Region.* Cf. *Consanguinity.*

J. W. Judd : *Q.J.G.S.*, xlii, 1886, p. 54 (Bohemia and Hungary).
J. P. Iddings : *Bull. Phil. Soc., Wash.*, p. 128, 1892.
— *Journ. Geol.*, i, 1893, p. 166 (Andes).
W. C. Brögger : *Eruptivgest. Kristiania*, i, 1894; ii, 1895; iii, 1898.
H. S. Washington : *Journ. Geol.*, vii, 1899, p. 463 (Essex Co., Mass.).
— *Bull. Geol. Soc. Am.*, xi, 1900, p. 389 (Magnet Cove, Arkansas).
T. H. Holland : *Mem. Geol. Surv. India*, xxviii, Pt. 2, 1900 (Charnockite Series).
A. Lacroix : *Nouv. Arch. du Mus. d'Hist. Nat.*, 4 Sér., i and v, 1902-3 (Madagascar).
G. T. Prior : *Min. Mag.*, xiii, 1903, p. 233 (Brit. E. Africa and Atlantic Is.).
F. W. Adams : *Journ. Geol.*, xi, 1903, p. 239 (Monteregian Hills).
A. Harker : *Mem. Geol. Surv.* (Tert. Ig. Rocks, Skye), 1904.
L. V. Pirsson : *Am. Journ. Sci.*, xx, 1905, p. 35 (Montana).
H. S. Washington : *Carnegie Inst., Washington*, Pub. 57, 1906 (Roman District).
—— *Trans. Am. Inst. Min. Eng.*, xxxix, 1909, p. 735 (General).
A. Harker : *Nat. Hist. Ig. Rocks*, 1909, p. 88 (General).
N. V. Ussing : *Medd. om Grönland*, xxxviii, 1910 (Greenland).
G. S. Rogers : *Ann. New York Acad. Sci.*, xxi, 1911, p. 11 (Cortlandt Series).
G. W. Tyrrell : *Geol. Mag.*, 1912, pp. 69 and 120 (late Palæozoic, Scotland).

H. H. Robinson: *U.S.G.S., Prof. Pap.* 76, 1913 (San Francisco Volcanics).
M. Stark: *Fort. der Min. Krist. u. Pet.*, iv, 1914, p. 251 (General and bibliography).
J. J. O'Neill: *Geol. Surv. Canada, Mem.* 43 (Pub. No. 1311), 1914 (Monteregian Hills).
W. Cross: *U.S.G.S., Prof. Pap.*, 1915 (Hawaii).
R. A. Daly: *Bull. Geol. Soc. Am.*, xxvii, 1916, p. 325 (Pacific Is.).
A. Holmes: *Q.J.G.S.*, lxxii, 1916-17, p. 260 (E. Africa).
—— *Min. Mag.*, xviii, 1916, p. 70 (Angola).
A. Harker: In *Handbuch der Regionalen Geologie*, iii, i, 1918 (British Isles).
—— *Q.J.G.S.*, lxxiii, 1917-18, p. lxvii (British Is.).
A. Holmes: *Min. Mag.*, xviii, 1918, p. 180 (Arctic Is.).

Petrography. — A general term for the systematic description of rocks, based on observations in the field, on hand-specimens and on thin sections. *Petrography* is thus wider in its scope than *Lithology*, but more restricted than *Petrology*, which implies interpretation as well as description. In their French usage, however, the terms *petrographie* and *lithologie* are synonymous.

Petrology.—A general term for the study by all available methods of the natural history of rocks, including their origins, present conditions, alterations and decay. Petrology comprises *petrography* on the one hand, and *petrogenesis* on the other, and properly considered, its subject matter includes ore-deposits and mineral deposits in general as well as "rocks" in the more limited sense in which that term is generally understood.

Petrosilex.—See **Felsite.**

Phacolith, *Harker,* 1909.—A concordant minor intrusion occupying the crest or trough of a fold. Unlike a laccolith, its form is the consequence of folding, not the cause.

A. Harker: *Nat. Hist. Ig. Rocks,* 1909, p. 77.

Phanerocrystalline.—A term applied to igneous rocks in which all the crystals of the essential minerals can be distinguished individually by the naked eye; contrasted with *aphanitic.*

Phase, *Gibbs.*—A homogeneous part of any system of substances which is mechanically separable from every other homogeneous but dissimilar part of the system (*e.g.*, a vapour, a solution, or a crystal). Cf. *Component.*

Phase Rule.—A thermodynamic generalisation which states that in any system—

$$P+f = n+2.$$

where P denotes the number of co-existing *phases* in the system;

f denotes the *degrees of freedom;* and

n denotes the number of independent *components* which compose the system.

A. Findlay: *The Phase Rule,* London, 1918.

Phenocrysts, *Iddings,* 1892.—A general term applied to the large megascopically visible crystals of porphyritic rocks.

L. V. Pirsson: *Am. Journ. Sci.,* vii, 1899, p. 271.
T. L. Watson: *Journ. Geol.,* ix, 1901, p. 97.

Phonolite, *Klaproth,* 1801. — An aphanitic rock with or without phenocrysts, consisting of alkali-felspars and felspathoids, with pyroxenes and amphiboles, the mafic minerals being generally soda-bearing varieties.

G. T. Prior: *Min. Mag.,* xiii, 1902, p. 237.

Phosphorite. — A term applied to concretionary masses or metasomatised rocks, consisting mainly of calcium phosphate (hydro- or fluo-calcium carbono-phosphate).

O. Stutzer: *Zeit. f. Prakt. Geol.,* xix, 1911, p. 73.
A. L. du Toit: *Geol. Surv. S. Af. Mem.,* 10, 1917.

Phreatic, *Daubrée,* 1887.—A term applied to ground-waters, *i.e.*, to seepage waters occurring at and below the water-table, drainage waters above the water-table being called *vadose.*

R. A. Daly: *Econ. Geol.,* xii, 1917, p. 494.

Phtanite, *Haüy.*—A term applied to compact cryptocrystalline silicified shales and other siliceous rocks such as lydite, hornstone, etc. = *Phthanite.*

G. F. Becker: *U.S.G.S., Mon.* xiii, 1888, p. 105.

Phyllite, *Naumann.* — A compact lustrous schistose rock with its minerals less well defined than in a mica-schist, the characteristic mineral by which the foliation is controlled being sericite.

Picrite, *Tschermak*, 1866.—A melanocratic rock which differs from peridotite in containing a small amount of felspar (usually labradorite). The term has also been extended to include similar rocks, often associated with teschenites, in which analcite is present. These should be distinguished as *Analcite-picrite.*

G. W. Tyrrell : *Q.J.G.S.*, lxxii, 1916-17, p. 84.
A. Holmes : *Geol. Mag.*, 1917, p. 150.

Picrite-basalt.—A melanocratic basalt characterised by abundant micro-phenocrysts of olivine and augite, in a groundmass containing only a small proportion of labradorite ; = *Felspathic limburgite.*

A. Holmes : *Q.J.G.S.*, lxxii, 1916-17, p. 244.

Pienaarite, *Brouwer,* 1910. — A melanocratic variety of ægirine-foyaite characterised by exceptional richness in sphene. (Bushveld.)

Piezocrystallisation, *Weinschenk*, 1900.—A term applied to the crystallisation of a viscous and constrained magma during the operation of powerful directed pressure, the latter condition implying that the normally-formed pyrogenetic minerals may not be stable as they would be under conditions of hydrostatic pressure.

E. Wienschenk : *Cong. Geol. Inter., C.R.*, viii (1900), p. 326.

Pilandite, *Henderson*, 1898. — A variety of porphyry characterised by the abundance of anorthoclase as phenocrysts and in the groundmass ; the porphyritic equivalent of hatherlite.

(Pilandsberg, Bushveldt.)

Pillow Lavas, *Bonney,* 1893.—A general term applied to basaltic or albitised basaltic rocks that exhibit *ellipsoidal* or *pillow* structure.

H. Dewey & J. S. Flett : *Geol. Mag.*, 1911, p. 202, p. 241.
J. V. Lewis : *Bull. Geol. Soc. Am.*, xxv, 1914, p. 595.

Pilotaxitic Texture, *Rosenbusch,* 1887.—A texture, developed typically in the groundmass of certain andesites, due to a felt-like interweaving of felspar microlites; probably a variety of micropoikilitic texture in which the host mineral is generally quartz.

Pinolite, *Rumpf,* 1873.—A metamorphic rock containing crystals and granular aggregates of magnesite (breunnerite variety) in a schistose matrix which may be phyllite or talc-schist. The rock derives its name from the resemblance of the magnesite bodies to pine cones. (Styria.)

T. Crook: *Trans. Ceramic Soc.,* 1919, p. 81.

Pipe-amygdales, *Cohen,* 1875. — Amygdales of pipe-like form extending upwards with swellings or bifurcations from the base of a lava-flow, to which they may be normal or inclined. The form and location of these amygdales are probably due to the flow of lava over a moist floor.

A. L. Du Toit: *Geol. Mag.,* 1907, p. 13.

Piperno.—A local Italian name given to the trachytic tuffs or eutaxitic trachytes of the Phlegrean Fields.

Pisolite.—A coarse-grained variety of oolite made up of oolite-grains of about the size of a pea.

Pitchstone.—A term applied to more or less devitrified glassy igneous rocks of various compositions, characterised externally by a dull pitch-like lustre, and internally by the presence of crystallites. Rhyolite-, dacite-, andesite-, and other varieties of pitchstone are distinguished when evidence of composition is available.

A. Scott: *Trans. Geol. Soc. Glasgow,* xv, 1914, p. 1.
E. M. Anderson & E. G. Radley: *Q.J.G.S.,* lxxi, 1915, p. 205.

Plagiaplite, *Duparc & Pearce,* 1902. — A dioritic aplite containing oligoclase or andesine with subordinate amounts of hornblende and micas. By the incoming of quartz the type passes into gladkaite. (Koswa, N. Urals.)

L. Duparc & P. Pamfil: *Bull. Soc. franç Min.,* xxxiii, 1910, p. 366.

Plagiophyre, *Tyrrell,* 1912. — A term for rocks resembling orthophyres in texture, but containing plagioclase instead of orthoclase. The type example contains laths of andesine with interstitial chloritic minerals, iron-ores, and, in places, orthoclase. Cf. *Leucophyre.*

(Carrick Hills, Ayrshire.)

G. W. Tyrrell: *Trans. Geol. Soc. Glasgow,* xv, 1912-13, p. 77.

Planophyric, *C.I.P.W.,* 1906.—A term applied to porphyritic rocks in which the phenocrysts are arranged in layers.

Plasticity.—The property of a substance whereby it can be permanently deformed without rupture. A *plastic* solid is one in which recovery from a state of strain is only partial. The permanent deformation thus produced is called *permanent set.* The stress just necessary to cause permanent set is called the *elastic limit,* and a body strained beyond this limit flows until the stresses are reduced below it. When the elastic limit is zero, as in pitch, and permanent set is acquired at a rate proportional to the shearing-stress applied, the plasticity (viscosity of some authors) is described as *elastico-viscosity.*

L. Milch: *Geol. Rund.,* ii, 1911, p. 145.

F. D. Adams & J. A. Bancroft: *Journ. Geol.,* xxv, 1917, p. 597.

H. Jeffreys: See *Geol. Mag.,* 1916, p. 126.

Platy Structure.—A structure due to differential contraction during cooling, occurring in lavas and intrusions as a series of fractures parallel to the cooling surface. Igneous rocks may thus be cracked into thin plates or tabular sheets, which give them a stratified appearance, especially as seen in the field when the structure has been developed by weathering.

Plauenite, *Brögger,* 1895. — The type syenite of Plauen, near Dresden.

H. S. Washington: *Am. Journ. Sci.,* xxii, 1906, p. 132.

Pleochroic Haloes.—A term applied to coloured zones occurring around radioactive inclusions (*e.g.*, zircon) in certain minerals (*e.g.*, micas, tourmaline, cordierite), characterised by darker tints than the enclosing mineral, by pleochroism, and by a zoned structure. The zones are parallel to the periphery of the inclusion, about which they have developed as a consequence of the emission of α-particles (helium atoms, positively charged) from the radioactive elements contained in it. = *Radio-haloes*.

J. Joly: *Phil. Mag.*, xix, 1910, pp. 321 & 630; xxv, 1913, p. 644.

—— *Phil. Trans. Roy. Soc.*, ccxviiA, 1917, p. 51.

Plumasite, *Lawson*, 1903.—A phanerocrystalline rock consisting essentially of oligoclase and corundum. (Plumas Co., California.)

A. C. Lawson: *Bull. Dept. Geol. Univ. California*, iii, 1903, p. 219.

"Plus" Minerals, *Lœwinson-Lessing*, 1897.—A term applied to minerals (such as felspars) whose molecular volumes are greater than the sum of the molecular volumes of the constituent oxides. In the case of allotropic modifications of the latter, that having the larger molecular volume is used in the calculation. Cf. *"Minus" Minerals*.

F. Lœwinson-Lessing: *Cong. Geol. Inter., C.R.*, vii, 1897, p. 194.

Plutonic.—A general term applied to major intrusions and to the rocks of which they are composed, suggestive of the depths at which they were formed in contradistinction to most minor intrusions and all volcanic rocks.

Pneumatolysis, *Bunsen*.—The process whereby minerals (whether occurring in ore-deposits or not) are produced wholly or in part from volatile compounds of one or other of their constituents, the agents concerned being the magmatic gases known as *mineralisers*.

A. Harker: *Nat. Hist. Ig. Rocks*, 1909, p. 282.

Poecilitic Texture.—See **Poikilitic**.

Poikilitic Texture, *Williams,* 1886. — A texture in which small granular crystals are irregularly scattered without common orientation in larger crystals of another mineral. The term has also been applied to the variegated marls of the Trias.

G. H. Williams: *Journ. Geol.,* i, 1893, p. 176.

Poikiloblastic, *Becke,* 1903.—A metamorphic texture due to the development, during recrystallisation, of a new mineral around numerous relics of the original minerals, thus simulating the poikilitic texture of igneous rocks. When the included relics also reveal the original texture of the rock, the new texture is *helicitic* (*q.v.*).

Poikilophitic Texture, *Johannsen,* 1911. — A term suggested for a variety of ophitic texture in which the pyroxenic matrix completely includes laths of plagioclase, and is not merely penetrated by them.

Pollenite, *Lacroix,* 1907.—A heteromorphic variety of campanite containing orthoclase, subordinate oligoclase, sodalite, and nepheline, with biotite, olivine, melanite, and sphene.

(Pollena, Mte. Somma.)

A. Lacroix: *Nouv. Arch. du Mus. d'Hist. Nat.,* ix, 1907, p. 137.

Polzenite, *Scheumann,* 1913. — A variety of melilite-basalt. (Polzen, Bohemia.)

Ponzite, *Washington,* 1913. — A term suggested for trachytes of the Ponza type (Rosenbusch); characterised by the presence of pyroxene (diopside and ægirine-augite) as the chief mafic mineral.

Porcellanite.—A compact thermally-metamorphosed rock of light colour and porcelain-like appearance, derived from marls or shales.

Porfido rosso antico. — The withamite-bearing hornblende-porphyrite of Djebel Dokhan in Egypt.

Porosity.—The ratio, P, expressed as a percentage, of the volume, V_p, of the pore-space in a rock to the

volume, V_r, of the rock, the latter volume including rock material plus the pore-space.

$$P = 100\ V_p/V_r.$$

J. Allen Howe: *The Geology of Building Stones,* London, 1910, p. 313.

A. L. Du Toit: *Trans. Roy. Soc., S. Africa,* iv, 1915, p. 169.

A. Holmes: *The Geological and Physical Characters of Concrete Aggregates.* B.F.P.C. Red Book, 256, 1920, p. 133. *Petrographic Methods and Calculations,* 1920.

Porphyrite.—A term which has been variously used for pre-Tertiary andesitic rocks, altered andesite rocks, and hypabyssal rocks of marked porphyritic texture and andesitic composition. The last usage referred to is that now customary. The phenocrysts are generally plagioclase (average composition that of andesine) and mafic minerals, and the groundmass is holocrystalline and more coarsely grained than in andesite. To avoid confusion some writers prefer terms such as *diorite-porphyry* and *andesite-porphyry*. Cf. *Porphyry*.

Porphyritic Texture.—A texture of igneous rocks due to the presence of crystals (phenocrysts) which are conspicuously larger than the mineral individuals of the groundmass through which they are sprinkled.

Porphyroblast. *Becke,* 1900. — A term given to the pseudo-porphyritic crystals of rocks produced by thermodynamic metamorphism. The corresponding texture is called *porphyroblastic.*

Porphyroclastic Structure, *Becke,* 1903. — See **Mortar** or **Murbruk Structure.**

Porphyro-granulitic Texture, *Judd,* 1885.—A texture of certain dolerites which contain phenocrysts of felspar and olivine in a base of lath-shaped felspars and irregular grains of augite; *i.e.*, a combination of porphyritic and intergranular textures.

J. W. Judd: *Q.J.G.S.,* xli, 1885, p. 261.

Porphyroid, *Lossen,* 1869. — A term applied to porphyroblastic metamorphic rocks intermediate

structurally between hälleflinta and granite-gneiss, in the same way as quartz-porphyry or granite-porphyry are intermediate between rhyolite and granite. The term has been extended to include porphyroblastic schists of sedimentary origin.

P. Quensel: *Bull. Geol. Inst. Upsala*, xii, 1913, p. 265.

Porphyry.—A term first given to an altered variety of porphyrite (*porphyrites lapis*) on account of its purple colour, and afterwards extended by common association to all rocks containing conspicuous phenocrysts in a fine-grained or aphanitic groundmass. The resulting texture is described as *porphyritic*. In its restricted usage, without qualification, the term *porphyry* usually implies a hypabyssal rock containing phenocrysts of alkali-felspar, though in the field it is generally allowed a wider scope, and commercially it is used for all porphyritic rocks. With mineral- and rock-name qualifiers it is used in combinations such as *quartz-porphyry, nepheline-porphyry, granite-porphyry*, etc., while in an amputated form, *-phyre*, first introduced by Brongniart in 1813, and used as a suffix, it appears in terms such as *melaphyre, lamprophyre, leucitophyre*, etc.

Prasinite, *Kalkowsky*, 1886. — A variety of green schist, in which hornblende, chlorite, and epidote are present in approximately equal proportions.

Predazzite. *Petzholdt*. — A variety of dedolomitised crystalline limestone containing brucite, the latter mineral being in less amount than in *pencatite*, in which the molecular proportions of CaO : MgO are those of dolomite. (Predazzo, Tyrol.)

A. F. Rogers: *Am. Journ. Sci.*, xlvi, 1918, p. 582.

Primary Igneous Gneiss, *Harker*.—See **Gneissose Granite.**

Propylite, *v. Richthofen*, 1868. — A name given to hydrothermally-altered varieties of andesite or dacite; generally containing secondary calcite and silica, chlorite and sulphides.

J. W. Judd: *Q.J.G.S.*, xlvi, 1890, p. 341.

Propylitisation. — The late-magmatic processes, involving the introduction of carbon-dioxide, sulphur, and water, whereby andesitic and related rocks are altered.

Proteolite, *Boase,* 1832.—An old term for hornfelsic rocks. *Bonney* proposes to revive the term for hornfels composed of quartz, mica, and andalusite. Cf. *Cornubianite.*

T. G. Bonney: *Q.J.G.S.,* xlii, 1886, p. 104.

Proterobase, *Gumbel,* 1874. — An altered doleritic or basaltic rock containing purple-brown augite and primary brown hornblende, and characterised by the presence of secondary green hornblende and other alteration products. The rock to which the name was first applied is a Silurian diabase in the Fichtelgebirge.

J. S. Flett: *Mem. Geol. Surv.,* 335-336 (Padstow and Camelford), 1910, p. 43.

Protoclastic Structure.—A structure produced by the granulation of minerals of early formation, the granulation being due to differential flow of the partly consolidated magma from which the fractured minerals separated.

Protogenous, *Naumann,* 1858. — A group name for "original" rocks as opposed to "derived" rocks, and including saline deposits, coal, igneous rocks, and ore-deposits. The term is no longer used. Cf. *Deuterogenous.*

Protogine, *Jurine,* 1806.—A term applied to the central granite of the Alps, which, being gneissose in structure, and containing sericite, chlorite, epidote and garnet, is considered to be of composite origin or else to have crystallised, or in part to have recrystallised, under stress during or after consolidation.

L. Duparc et L. Mrazec: *Arch. Sci. Phys. et Nat., Geneva,* v, 1898.

Protomylonite, *Backlund,* 1918. — A mylonitic rock produced from contact-metamorphic rocks, granulation and flowage being due to overthrusts

following, in the first place, the contact-surfaces between the intrusion and the country-rock. The first rocks to be crushed and rolled out during the process are thus the metamorphic rocks already produced in contact with the intrusion.

H. G. Backlund : *Geol. För. Förh.*, xl, 1918, p. 195.

Prowersite, *Rosenbusch*, 1908, after **Prowersose,** *Cross*, 1906.—A syenitic lamprophyre of fine grain, containing abundant biotite and orthoclase, with smaller amounts of augite, altered olivine, and iron-ore minerals. A variety containing porphyritic perthite is also known.

(Prowers Co., Colorado.)

W. Cross : *Journ. Geol.*, xiv, 1906, p. 165 ; see also p. 173.

Psephicity, *Mackie*, 1897. — The degree of "roundness" characterising pebbles or sand-grains. The *coefficient of psephicity* is the ratio of specific gravity to hardness, and roughly expresses the relative facility with which minerals can be rounded.

W. Mackie : *Trans. Edin. Geol. Soc.*, vii, 1897, p. 301.

Pseudo-conglomerate.—An autoclastic conglomerate formed by fragmentation and rolling nearly *in situ*, due to the action of orogenic forces ; = *Crush-conglomerate.*

Pseudo-porphyritic.—A metamorphic texture due to the development during recrystallisation of large well-defined crystals, such as those of garnet in mica- and chlorite-schists ; = *Porphyroblastic.*

Pseudotachylyte, *Shand*, 1914.—A black rock externally resembling tachylyte and occurring in irregularly branching veins. The material carries fragmental enclosures, and shows evidence of having been at a high temperature ; microlitic and spherulitic crystallisation took place in the extremely dense base. Pseudotachylyte differs from *flinty crush-rock* (*q.v.*) in its intrusive habit, and in the absence of any structures referable to local crushing. (Parijs, Orange Free State.)

S. J. Shand : *Q.J.G.S.*, lxxii, 1916-17, p. 198.

Pteropod Ooze, *Murray*, 1873.—A calcareous deep-sea deposit characterised by an abundance of pteropod remains.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 223.

Ptygmatic Folding, *Sederholm*, 1907. — A term proposed for the primary folding in migmatites (injection gneisses, etc.), caused by the processes to which the migmatites owe their origin and composite character.

J. J. Sederholm : *Bull. Comm. Géol. Finlande*, No. 23, 1907, p. 110.

Puddingstone. — A popular term for conglomerates, consisting of well-rounded pebbles set in an abundant matrix. The Hertfordshire Puddingstone, to which the name is most commonly applied, is a local facies of the Reading Pebble-beds, which has been cemented into a hard siliceous flint-conglomerate.

G. Barrow : *Proc. Geol. Assoc.*, xxx, 1919, p. 5.

Puglianite, *Lacroix*, 1917.—A phanerocrystalline rock composed essentially of augite, leucite, and anorthite. (Mte. Somma.)

A. Lacroix : *C.R.*, clxv, 1917, p. 210.

Pulaskite, *Williams*, 1890. — A porphyritic nepheline-syenite containing soda-orthoclase, with ægirine-augite, barkevikite, and biotite as its characteristic mafic minerals. (Pulaski Co., Arkansas.)

Pumice.—A general term applied to lavas so extremely vesiculated as to resemble froth. Varieties of rhyolitic composition are generally light-coloured and characterised by a sub-pearly lustre.

Pumiceous Structure.—A structure akin to that of a coarse froth, due to the extreme vesiculation of a lava by expanding gases and vapours.

Pyribole, *Johannsen*, 1911.—A general term for minerals belonging to either the pyroxene or amphibole groups, suggested for field use.

Pyroclasts.—A general term for fragmental deposits of volcanic ejectamenta, including volcanic conglomerates, agglomerates, tuffs, and ashes.
L. V. Pirsson: *Am. Journ. Sci.*, xl, 1915, p. 191.
J. F. N. Green: *Proc. Geol. Assoc.*, xxx, 1919, p. 153.

Pyrogenetic Minerals.—A term applied to the primary magmatic minerals of igneous rocks, excluding those due to pneumatolytic, hydrothermal, and thermodynamic processes. In practice many cases of doubtful character arise, since the solidification of a magma may constitute a continuous process beginning with indubitable pyrogenetic minerals, and yet finishing with a well-defined hydrothermal series of minerals.

Pyromeride, *Monteiro*, 1814. — A quartz-felsite or devitrified rhyolite characterised by conspicuous spherulitic or lithophysal structure, and thus having a nodular appearance.
J. Parkinson: *Q.J.G.S.*, liv, 1898, p. 101.

Pyroxenite, *Coquand*, 1857. — A general term for phanerocrystalline rocks consisting predominantly of pyroxenes. Both quartz- and olivine-bearing varieties are recognised, and those containing ægirine-augite or traces of felspathoid are referred to as *alkali-pyroxenite*. Although the above usage is now customary in English-speaking countries, it should be noticed that in France the term *pyroxénite* is given to melanocratic facies of pyroxene granulite.

Pyroxenolite, *Lacroix*, 1894. — A general term for phanerocrystalline rocks of igneous origin, consisting predominantly of pyroxenes; *pyroxénite* (French usage) being restricted to metamorphic rocks of the same mineral composition.

Q

Quartz-barytes Rock, *Holland*, 1897. — A rock composed of about 30 per cent. barytes and 70 per cent. quartz, and considered to be of magmatic origin, occurring in the Salem district of Madras as a network of pegmatite-like veins.

T. H. Holland: *Rec. Geol. Surv. India,* xxx, 1897, p. 236.

Quartz-diorite. — A phanerocrystalline igneous rock composed of quartz, plagioclase (averaging oligoclase or andesine), hornblende, and generally biotite. If orthoclase be present in addition, but in amount inferior to that of the plagioclase, the rock is then described as *granodiorite.* Cf. *Tonalite.*

Quartz-dolerite.—An oversaturated variety of dolerite containing interstitial quartz. The latter mineral is frequently associated with orthoclase in micropegmatite, and when this is present the rock is described as *granodolerite.*

Mem. Geol. Surv. (Glasgow District), 1911, pp. 118 and 146.
G. W. Tyrrell: *Geol. Mag.* 1909, p. 299.

Quartz-felsite.—A rhyolite or quartz-porphyry having a cryptocrystalline or devitrified groundmass; in the older usage of the name it was synonymous with quartz-porphyry, but the latter term is now more commonly used, especially when conspicuous phenocrysts are present.

Quartzite.—A granulose metamorphic rock, representing a recrystallised sandstone, consisting predominantly of quartz. The name is also used for sandstones and grits cemented by silica which has grown in optical continuity around each fragment.

W. J. Sollas: *Sci. Proc. Roy. Dublin Soc.,* vii, 1892, p. 169.
L. Cayeux: *Structure et Origine des Grès du Tertiare parisien, Paris,* 1907.

Quartz-porphyry.—A rock containing phenocrysts of quartz and alkali-felspar, typically orthoclase, with or without mica, in a cryptocrystalline or micro-

crystalline groundmass. If phenocrysts are abundant the rock becomes *granite-porphyry*, while if they are absent or inconspicuous, the terms *quartz-felsite* and *microgranite* are used according to the nature of the groundmass.

J. Morrison: *Q.J.G.S.*, lxxiv, 1918-19, p. 116.

Quartz-schist.—A schist in which the foliation is due to the presence of streaks and lenticles of non-granular quartz. Mica is usually present, but in less amount than in mica-schist.

Queluzite, *Derby*, 1901.—A manganese-garnet (spessartite) rock, in some varieties containing amphiboles, pyroxenes or micas, with or without free manganese-oxides. Residual deposits derived from this rock constitute valuable manganese-ores. (Queluz, Minas Geraes, Brazil.)

O. A. Derby: *Am. Journ. Sci.*, xii, 1901, p. 18; xxv, 1908. p. 213.

R

Radio-activity. — An atomic property of certain elements belonging to the uranium and thorium families, whereby they spontaneously disintegrate with external emission of energy, carried in the form of α-particles (positively charged helium atoms) or β-particles (electrons), into elements of lower intrinsic energy, and, where α-particles are lost, of lower atomic weight. Owing to the distribution of radioactive elements in the earth's crust, radiothermal phenomena are of critical importance in all geological processes in which heat is an active agent.

A. Holmes: *Science Progress*, No. 33, 1914, p. 12.
— *Geol. Mag.*, 1915, pp. 60, 102; 1916, p. 265.
— *Proc. Geol. Assoc.*, xxvi, 1915, p. 289.
— *Q.J.G.S.*, lxxiv, 1918-19, pp. 63, 84.

Radio-haloes, *Hirschi*, 1920.—See **Pleochroic Haloes.**

Radiolarian Ooze, *Murray*, 1873. — A variety of *red clay* (*q.v.*) characterised by an abundance of the siliceous skeletons of radiolaria and of certain diatoms.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 203.

Raglanite, *Adams & Barlow*, 1910. — A facies of nepheline-syenite containing in order of abundance, oligoclase, nepheline, and corundum, with small quantities of micas, calcite, magnetite, and apatite. (Ontario.)

F. D. Adams & A. E. Barlow : *Geol. Surv. Canada Mem.* 6 (Pub. No. 1082), 1910, p. 314.

Randannite, *Salvetat.*—A local variety of diatomaceous earth occurring in the neighbourhood of the Puy-de-Dôme. (Randanne.)

Rang, *C.I.P.W.*, 1902.—A division of igneous rocks considered after the division into orders, based (in classes I., II. and III.) on the relative proportions of the molecules of salic K_2O and Na_2O to those of salic CaO. This division is analogous to the more general division of rocks into *alkali-* and *calc-alkali* types, and usually fails to express the kind of felspar present. In classes IV. and V. the rangs are based on the relative proportions of the molecules of MgO,FeO, and femic CaO to those of femic K_2O and Na_2O. This is analogous to the division of perknites, peridotites and similar rocks into normal and alkali-types.

Rapakivi, *Sederholm*, 1891. — A hornblende-biotite granite containing large rounded crystals of orthoclase mantled with oligoclase. The same term has also been applied to the youngest pre-Cambrian granites of the Christiania District.

Ratio of Absorption.—The ratio, A, expressed as a percentage of the volume V_p of the pore-space in a rock to the weight W of the rock when dry.

$$A = 100\ V_p/W.$$

A. Holmes : *The Geological and Physical Characters of Concrete Aggregates*, B.F.P.C. Red Book, 256, 1920, p. 134.

Reaction Rim.—A term applied to a peripheral zone of mineral aggregates formed around one mineral (*e.g.*, hypersthene), by reaction with another (*e.g.*, plagioclase), with which it would otherwise come into contact. Cf. *Kelyphitic; Corona.*

T. H. Holland : *Mem. Geol. Surv. India*, xxix, 1896, p. 20.

Red Clay.—A widespread deep-sea deposit consisting of ferruginous clayey alteration products of volcanic débris, wind-borne particles from desert regions, zeolite crystals, concretionary manganese and iron oxides, meteoritic matter, and a variable content of siliceous or calcareous remains. Where the depth is great organic remains may be entirely absent owing to the solvent action of sea-water which overtakes them as they sink towards the ocean floor. At suitable depths and beneath a suitable environment the red clay passes laterally into globigerina ooze, radiolarian ooze, or diatom ooze, all of which have an inorganic residue resembling red clay.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 190.

Red Mud.—A reddish-brown terrigenous deep-sea mud which accumulates on the sea-floor in the neighbourhood of deserts and off the mouths of great rivers; contains $CaCO_3$ up to 25 per cent.

J. Murray : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 234.

Refractories or **Refractory Materials.** — Materials which will withstand with at least some degree of success the effects of the heat and chemical reactions involved in metallurgical and other high-temperature processes. They are classified as

Acid—*e.g.*, fireclay, ganister, and sand;

Neutral—*e.g.*, chromite and graphite; and

Basic—*e.g.*, bauxite and magnesite.

R. Hadfield : *Trans. Faraday Soc.*, xi, 1916.

P. G. H. Boswell : *British Resources of Refractory Sands*, Pt. 1, 1918.

Mem. Geol. Surv., Spec. Rep. Min. Resources, vi, 1918.

T. Crook : *Trans. Ceramic Soc.*, 1919, p. 67.

Regional Metamorphism, *Daubrée*, 1860.—A general term for metamorphism due to the sum of the processes which have affected the rocks over extensive areas; contrasted with local *metamorphism* in which each area affected is restricted to an aureole of limited extent, and related to a definite intrusion of magma. Originally the term covered changes due to deep burial and the action of heat and hot gases from the interior; by many writers it has been used as synonymous with *dynamic* metamorphism, and by others in the sense defined above, but with the proviso that the metamorphism is not genetically connected with the intrusion of magmas. This specified limitation would often be difficult to substantiate, for many of the features of *regional* metamorphism are not distinguishable from those of *local* or *contact* metamorphism, except in uniformity, depth and extent.

F. D. Adams: *Q.J.G.S.*, lxiv, 1908, p. 127.
G. Barrow: *Proc. Geol. Assoc.*, xxiii, 1912, p. 274.
R. A. Daly: *Bull. Geol. Soc. Am.*, xxviii, 1917, p. 394.
For other references see under **Metamorphism.**

Regolith, *Merrill*, 1906.—A general term for the superficial blanket of denudation products which is widely distributed over the more mature "solid" rocks. The term includes weathering residues, alluvium, and æolian and glacial deposits.

G. P. Merrill: *Rocks, Rock Weathering, and Soils*, 1906, p. 287.

Resorption. — The partial or complete solution by a magma of a mineral, or its components, with which it is not in equilibrium, or with which, owing to changes of temperature, pressure, or composition, it has ceased to be in equilibrium, The term is often wrongly applied to immature crystals, and to crystals which have decomposition borders through change of pressure or otherwise.

O. Andersen: *Am. Journ. Sci.*, xxxix, 1915, p. 451.

Resurgent, *Daly,* 1908.—A term applied to magmatic emanations derived not from the magma itself (*juvenile*), but from entrapped country rock.

R. A. Daly : *Econ. Geol.,* xii, 1917, p. 491.

Rhomb-porphyry, or **Rhombenporphyr,** *v. Buch.*—A variety of alkali-syenite-porphyry containing phenocrysts of anorthoclase or potash-oligoclase (rhomb-shaped in section), small augites and occasionally olivine, in a fine-grained groundmass consisting mainly of alkali-felspars; = *Kenyte* (in part).

P. Quensel : *Bull. Geol. Inst. Upsala,* xvi, 1918, p. 1.

Rhyobasalt. *Shand,* 1917. — A term suggested for rocks which are the effusive equivalent of granodolerite (*q.v.*).

Rhyocrystal, *Wright,* 1902.—A term applied to crystals of idiomorphic outline which are arranged in stream-lines.

A. C. Lane : *Bull. Geol. Soc. Am.,* xiv, 1902, p. 386.

Rhyolite, *v. Richthofen,* 1861.—A volcanic rock corresponding in chemical composition to granite, and generally having small phenocrysts of quartz and othoclase (or other alkali-felspar) in a glassy or cryptocrystalline groundmass. Flow structure is commonly developed, and spherulitic, nodular, and lithophysal structures are exhibited by many varieties.

J. P. Iddings : *U.S.G.S., 7th Ann. Rep.* (1885-6), 1888, p. 255 (Yellowstone Park).
A. Harker : *Bala Volcanic Series,* 1889, p. 9 (N. Wales).
H. Bäckström : *Geol. Fören i Stockholm Förh,* xiii, 1891, p. 637 (Iceland).
G. A. J. Cole : *Sci. Trans. Roy. Dublin Soc.,* vi, 1896, p. 77 (Antrim).
J. P. Iddings : *U.S.G.S., Mon.* xxxii (ii), 1899, p. 356 (Yellowstone Park).
W. S. Boulton : *Q.J.G.S.,* lx, 1904, p. 450 (Pontesford Hill).
H. H. Robinson : *U.S.G.S., Prof. Pap.,* 76, 1913, p. 103 (Arizona).

Riecke's Principle.—A thermodynamic principle which states that, since the vapour pressure of a sub-

stance is increased by external pressure, solution (*e.g.*, of a mineral) tends to take place most readily at points where the pressure is greatest, and recrystallisation where the pressure is least.

Rigidity. — The property possessed by solid bodies whereby they offer an elastic resistance to deformation.—See *Elasticity of Form.*

Rigid Solution, *Iddings,* 1913. — A term applied to rock-glass to connote its physical state, in contradistinction to a *solid solution* which implies a crystalline condition.

Ring-dyke.—A dyke which follows the course of an irregular ring-like fault, and of which the outcrops approximate to a closed curve more or less broken according to the conditions favouring exposure.

Geol. Surv. Summ. Prog. (1914), 1915, p. 36.
E. B. Bailey : *Geol. Mag.*, 1919, p. 466.

Ripple-mark. — An undulating surface-form produced by waves or currents of air or water at their contacts with unconsolidated sediments, the surface being thrown into a series of alternating ridges and furrows, which trend at right-angles or obliquely to the direction of the flow of the moving fluid, and which, hydrodynamically, represent surfaces of minimum friction.

E. M. Kindle : *Geol. Surv. Canada, Museum Bull.*, 25, 1917.
W. H. Bucher : *Am. Journ. Sci.*, xlvii, 1919, pp. 149 and 241.

Ripple-mark Index, *Kindle*, 1917.—The ratio of wavelength (horizontal distance from crest to crest, or from trough to trough) to twice the amplitude (vertical distance from trough to crest). For ripple marks due to water currents the ratio varies from 20 to 30, whereas for those due to air currents (wind) the ratio varies from 3 to 6. The index, therefore, provides a criterion of the origin of the ripple mark.

E. M. Kindle : *Geol. Surv. Canada, Museum Bull.*, 25, 1917, p. 12.

Rizzonite, *Doelter,* 1903.—A term applied to a local variety of *limburgite.* (Mt. Rizzoni, Tyrol.)

C. Doelter: *Anz. Akad. Wisch. Wien,* xl, 1903, p. 10.

Rock.—As a geological concept, *rock* may be defined as (*a*) any formation of natural origin that constitutes an integral part of the lithosphere, and that cannot be referred to a single fossil, or to a single individual of a mineral species; or (*b*) a representative specimen of such a formation.

"It is as the architectural elements of the earth's crust, rather than as aggregates of minerals or chemical constituents, that rocks are best and most fundamentally considered; and, unlike a mineral, a rock has no scientific significance except in so far as it can be regarded as representative of the mass from which it has been detached."—T. Crook: *Min. Mag.*, xvii, 1913, p. 65.

Rockallite, *Judd,* 1897. — A fine-grained mesocratic soda-granite, consisting of ægirine-acmite, quartz, and albite. (Rockall, N. Atlantic.)

H. S. Washington: *Q.J.G.S.*, lxx, 1914, p. 294.

Rock-flour. — A general term for finely comminuted rock-material corresponding in grade to mud, but formed by the grinding action of glaciers and ice-sheets, and therefore composed largely of unweathered mineral particles.

Rock-series. *Brögger,* 1904. — An assemblage of igneous rock types in a single district and belonging to a single period of igneous activity, characterised by a certain community of characters, chemical, mineral, and sometimes even textural.

A. Harker: *Journ. Geol.*, viii, 1900, p. 389.

Rodding Structure.—See **Mullion Structure.**

Rodingite, *Bell,* 1911.—A coarse-grained gabbro-like rock associated with *dunite,* containing diallage and grossularite. Altered varieties containing prehnite and/or serpentine are recognised. (Nelson, New Zealand.)

T. M. Bell: *Geol. Surv. New Zealand, Bull.*, 12, 1911, p. 21.

Rodite.—A brecciated achondritic meteorite composed of bronzite and olivine with small amounts of oligoclase and iron rich in nickel; = Brecciated *Amphoterite.*

Rohrbach Solution. — A yellow aqueous solution of barium mercuric iodide, having a maximum specific gravity of 3.55.

Rosiwal's Micrometric Method.—A method of determining the percentages (by volume) of the minerals in a rock, by measuring with an eye-piece micrometer the linear intercepts of each mineral, as seen in thin section along a series of lines suitably distributed over the section. The principle of the method was originally suggested by Delesse in 1848.

F. C. Lincoln & H. L. Rietz: *Econ. Geol.*, viii, 1913, p. 120.
S. J. Shand: *Journ. Geol.*, xxiv, 1916, p. 294.
A. Johannsen & E. A. Stephenson: *Journ. Geol.*, xxvii, 1919, p. 212.

Rougemontite. *O'Neill*, 1914. — A phanerocrystalline rock containing anorthite and titanaugite, with small amounts of olivine and iron-ores. (Rougemont, Montreal.)

J. J. O'Neill: *Geol. Surv. Canada Mem.*, 43, (Pub. No. 1311), 1914, p. 74.

Routivarite, *Sjögren*, 1893. — A fine-grained igneous rock composed of orthoclase, plagioclase, quartz, and garnet. (Routivara, Swedish Lapland.)

Rouvillite. *O'Neill*, 1914. — A leucocratic variety of theralite, containing about 53 per cent. of labradorite, and 27 per cent. of nepheline, with small amounts of titanaugite, brown hornblende, pyrite and apatite. (St. Hilaire, Montreal.)

J. J. O'Neill: *Geol. Surv. Canada Mem.*, 43 (Pub. No. 1311), 1914, p. 35.

Rubble.—A general term for coarse non-graded detritus.

Rudaceous, *Grabau*, 1904, = **Psephitic.** — Terms applied to sedimentary rocks composed of coarsely-graded detritus such as gravel, shingle, pebbles, etc.

S

Saccharoidal Texture.—A granular texture, resembling that of loaf-sugar, and typically developed in certain statuary marbles.

Sagvandite, *Rosenbusch,* 1883. — A granulose metamorphic rock composed essentially of pyroxene and calcite.

Salic, *C.I.P.W.,* 1906.—A mnemonic term (recalling *si*lica and *al*umina) applied to the group of standard normative minerals which includes quartz, felspars and felspathoids.

Saltation, *McGee,* 1908.—A mode of transportation of débris by running water, in which the particles make intermittent leaps from the bed of the stream; a form of movement intermediate between rolling or sliding, and suspension.

G. K. Gilbert: *U.S.G.S. Prof. Pap.,* 86, 1914, p. 15.

Sandstone.—A cemented or otherwise compacted detrital sediment composed predominantly of quartz grains, the *grades* of the latter being those of sand. Mineralogical varieties such as felspathic and glauconitic sandstones are recognised, and also argillaceous, siliceous, calcareous, ferruginous and other varieties according to the nature of the binding or cementing material. Corresponding rocks composed of coarser grades have been called *grits*, but the same term has also been used to connote angularity of grain, independently of grade-size.

L. Cayeux: *Structure et Origine des Grès du Terliare parisien,* Paris, 1907.

A. Holmes: *British Fire Prevention Committee,* Red Book, 256, 1920, p. 76.

Sandstone Dykes.—A term applied to dyke-like masses of sandstone formed by deposition in fissures from above or by injection into earthquake-fissures from below.

J. S. Diller: *Bull. Geol. Soc. Am.,* 1, 1890, p. 411.

Sanidinite. — This term has been variously used for igneous rocks composed mainly of sanidine or other forms of alkali-felspar, whether occurring as volcanic, phanerocrystalline, or porphyritic rocks, or as ejected blocks, cognate enclosures, or segregations.

A. Lacroix : *Enclaves des Roches volcaniques*, 1893
W. H. Weed & L. V. Pirsson : *Am. Journ. Sci.*, I, 1893, p. 479.

Santorinite, *Washington*, 1897. — A leucocratic volcanic rock, with normative quartz and a high content of silica (about 65 per cent.), composed mainly of plagioclase varying from labradorite to anorthite. The same name has been applied by Becke to hypersthene-andesites containing sodic andesine or oligoclase, to distinguish such rocks from *alboranite*. (Santorin.)

Sanukite, *Weinschenk*, 1890. — A volcanic rock of andesitic composition, containing crystals of hypersthene, garnet, and a little andesine in a glassy groundmass; = *garnetiferous boninite*.
(San-uka, Japan.)

Sapropelic Coals, *Potonié*, 1904.—A group of coals, including the cannel- and boghead-types, which are largely composed of the indurated jelly-like slime derived from macerated organic débris, and known as *sapropel*.

Särnaite, *Brögger*, 1883. — A variety of felspathoid-syenite containing cancrinite and ægirine.
(Särna, Sweden.)

Saturated, *Shand*, 1913.—A term applied to minerals (*e.g.*, felspars) which are capable of forming in the presence of free silica, and extended to describe rocks composed wholly of saturated minerals.

S. J. Shand : *Geol. Mag.*, 1913, p. 508; 1914, p. 485; 1915, p. 339.
A. Holmes : *Geol. Mag.*, 1917, p. 115.

Saussuritisation.—A term applied to processes whereby the plagioclase felspars of dolerites and other igneous rocks become altered by the breakdown of

the solid solution of albite and anorthite into a dense aggregate of *saussurite*. This material, originally thought to be a specific mineral, is composed essentially of albite (or oligoclase) and zoisite (or epidote), together with variable amounts of calcite, sericite, and calcium-aluminium silicates other than those of the epidote group. The alteration is specially characteristic of gabbros and greenstones (epidiorite and diabase), and is accompanied as a rule by uralitisation or chloritisation. It may be due to auto-, contact-, or low-grade dynamic-metamorphism.

G. H. Williams: *U.S.G.S. Bull.* 62, 1890, p. 67.

Saxonite, *Wadsworth*, 1884.—A peridotite containing orthorhombic pyroxene as the essential mineral, in addition to olivine; = *Harzburgite*.

Scapolite Rocks.—A general term for rocks containing scapolite — irrespective of its origin — as a major constituent.

J. E. Spurr: *Am. Journ. Sci.*, x, 1900, p. 310.
J. S. Flett: *Summ. Prog. Geol. Surv.* (1906), 1907, p. 116.
W. G. Foye: *Econ. Geol.*, xi, 1916, p. 677.
A. Lacroix: *Bull. Soc. franç. Min.*, 1916, p. 74.

Scapolitisation.—The processes whereby the aluminosilicate minerals of igneous rocks such as gabbro are replaced by scapolite. Plagioclase is the mineral commonly so altered, associated augite being changed concomitantly to hornblende.

Schalstein, *Stifft*, 1825.—A term for altered basaltic and spilitic rocks and tuffs; shearing structures (incipient schistosity and cleavage), and partial replacement of the rocks by calcite being characteristic features.

Schillerisation, *Judd*, 1885.—The development, along certain planes within a mineral, of minute inclusions which reflect light simultaneously and so give rise to the appearance known as "schiller."

J. W. Judd: *Q.J.G.S.*, xli, 1885, p. 383.

Schist. — A general term for foliated metamorphic rocks, the structures of which are controlled by

the prevalence of lamellar minerals such as micas, chlorite, talc, and hornblende (in part), which have normally a flaky or elongated habit; or of stressed minerals such as quartz and calcite, which have crystallised in elongated forms rather than in the granular forms generally assumed in the absence of shear. A common characteristic of schists is that they may be divided into foliæ which are mineralogically similar; whereas in gneisses, alternating bands or foliæ are usually mineralogically dissimilar, and the tendency to split is much less marked. Cf. *Foliation.*

For References, see under **Metamorphism.**

Schistosity.—The property of a foliated rock whereby it can be divided into thin flakes or lenticles, the property depending on the parallelism of the cleavage-planes of the lamellar minerals, such as biotite, to which the foliation is due.

Schlieren.—An old mining term applied to irregular masses, generally streaky in form, occurring in a body of igneous rock, from the normal type of which they differ transitionally in texture and/or composition. They may represent differentiation *in situ,* partial assimilation of fragments of country rock, or injections of residual liquors into already crystallised material.

Schönfelsite, *Uhlemann,* 1909.—A variety of picrite-porphyry containing phenocrysts of olivine and augite in an aphanitic groundmass composed of apatite, titaniferous magnetite, bronzite, and bytownite, in an interstitial base of brown glass and chloritic minerals.

(Altschönfels, Saxony.)

Uhlemann: *Tscherm. Mitt. Pet. Min.,* xxviii, 1909, p. 434.

Schorl Rock, *Boase,* 1832.—A Cornish term for a rock composed essentially of aggregates of black tourmaline (*i.e.,* of schorl) associated with quartz.

Schriesheimite, *Salomon,* 1904.—A variety of hornblende-picrite. (Schriesheim, Odenwald.)

Scopulite.—A variety of crystallite consisting of rods or stems terminated by divergent brushes or plumes, characteristic examples of which are found in the Corriegills pitchstone of Arran.

F. Rutley : *Min. Mag.*, ix, 1891, p. 261.

Scoriæ.—Light cellular masses of volcanic rock resembling clinkers.

Scyelite, *Judd,* 1885.—A hornblende-biotite-peridotite with well-marked poikilitic texture (lustre mottling) due to the inclusion of rounded olivines in large crystals of other minerals.

(Loch Scye, Caithness.)

J. W. Judd : *Q.J.G.S.*, xli, 1885, p. 401.

Sebastianite, *Lacroix,* 1917. — A phanerocrystalline rock composed of anorthite and biotite, with smaller amounts of augite and apatite. The type differs from puglianite, of which it is a heteromorphic form, in containing biotite instead of leucite. (Mte. Somma.)

A. Lacroix : *C.R.*, clxv, 1917, p. 210.

Secondary. — A general term applied to epiclastic rocks, and to minerals formed as a consequence of the alteration of pre-existing minerals. *Secondary* minerals may thus be formed *in situ* as pseudomorphs or paramorphs, or they may be deposited from solution in the interstices of a rock through which the solution is percolating. It has been proposed to apply the terms *deuteric* or *paulopost* (*q.v.*) to alterations and alteration products effected by processes genetically associated with those by which the *primary* mineral was formed ; restricting *secondary* to alterations and alteration products effected by later processes independent of those concerned with the genesis of the primary mineral. For example, tourmalinisation is a *paulopost* process, while lateritisation is a *secondary* process.

Secretions.—A general term applied to all materials which have been deposited from solution by infiltration in the cavities of rocks, *e.g.*, *amygdales*, *geodes*. Cf. *Concretions*.

Sedimentary Rocks.—A general term for loose and cemented sediments of detrital origin, generally extended to include all exogenetic rocks (residual, detrital, organic, and solution deposits). Cf. *Clastic*.

E. Andrée: *Geol. Rund.*, ii, 1911, pp. 61, 119.
A. C. Trowbridge: *Journ. Geol.*, xxii, 1914, p. 420.
G. M. Davies: *Proc. and Trans. Croydon Nat. Hist. and Sci. Soc.*, 1915-16, p. 53.
P. G. H. Boswell: *Geol. Mag.*, xxvii, 1916, pp. 105, 163.
L. Cayeux: *L'Etude pétrographique des Roches sedimentaires; Mem. Carte Géol. France*, 1916.
E. M. Kindle: *Journ. Geol.*, xxvii, 1919, p. 229.
W. Deeke: *Ber. Naturfor. Gesell.*, xxii, (i), 1919.

Seebenite, *Salomon*, 1898.—A variety of hornfels containing felspar and cordierite as the dominant minerals. (Seeben, near Klausen.)

Segregations.—A term applied to authigenous mineral aggregates, in masses or streaks, occurring in igneous rocks, and representing early products of crystallisation from the same respective magmas; = *Endogenous enclosures* = *Cognate inclusions*.

Selagite, *Cordier*, 1868.—A variety of mica-trachyte, or minette, characterised by abundant phenocrysts of bleached biotite in a groundmass of orthoclase and oligoclase laths with grains of diopside.

H. S. Washington: *Am. Journ. Sci.*, ix, 1900, p. 47.

Septarian Structure. — A structure developed in certain concretions known as *septarian nodules*, due to an irregular polygonal system of internal cracks, which are almost always occupied by calcite or other minerals. The structure closely resembles the desiccation-structure of mud-cracks, and is probably developed by a similar cause—contraction due to the desiccation of the colloidal material in the interior.

W. A. Richardson: *Min. Mag.*, xviii, 1919, p. 227.

Seriate Fabric, *C.I.P.W.*, 1906.—A variety of inequigranular texture, in which the sizes of the crystals form a continuously graded series.

J. P. Iddings: *Igneous Rocks*, I, 1909, p. 196.

Sericitisation.—The hydrothermal or other processes whereby alumino-silicate minerals are replaced by sericite.

W. Lindgren: *Trans. Am. Inst. Min. Eng.*, xxx, 1900, p. 609.

Series.—A term applied to a number of related rocks or minerals arranged, or capable of arrangement, in a natural sequence of succession, composition or other property; *e.g.*, *Charnockite Series, Pyroxene Series.* Stratigraphically the term is applied to the main subdivisions of Systems.

Serpentine. — A rock made up predominantly of serpentine; generally formed by the hydrothermal alteration of peridotites.

T. G. Bonney: *Q.J.G.S.*, xxxiii, 1877, p. 884; lxiv, 1908, p. 152.
J. S. Flett: *Mem. Geol. Surv.*, 359 (Lizard), 1912, p. 61.
R. P. D. Graham: *Econ. Geol.* xii, 1917, p. 154.
W. N. Benson: *Am. Journ. Sci.*, xlvi, 1918, p. 693.

Serpentinisation.—The process whereby magnesium-rich minerals and rocks are altered to serpentine.

Shackanite. *Daly*, 1912. — A variety of analcite-rhomb-porphyry.

(Shackan, Midway Range, British Columbia.)

R. A. Daly: *Geol. Surv. Canada, Mem.*, 38 (Pub. 1203), 1912, p. 414.

Shale. — A laminated sediment, in which the constituent particles are predominantly of the clay grade.

W. M. Hutchings: *Geol. Mag.*, 1894, pp. 36, 64; 1896, pp. 309, 343.

Shastaite, *Iddings*, 1913.—A general name suggested for andesine-dacites, *i.e.*, for normal dacites.

(Mt. Shasta, California.)

Shastalite, *Wadsworth*, 1891.—A term suggested for unaltered andesite-glass.

(Mt. Shasta, California.)

Sherghottite.—An achondritic meteorite mainly composed of augite and maskelynite.

Shimmer-aggregate. *Barrow*, 1893. — A micaceous aggregate replacing altered alumino-silicate

minerals such as kyanite and cordierite in metamorphic rocks.

G. Barrow: *Q.J.G.S.*, xlix, 1893, p. 340.

Shingle.—Loose detritus of coarser grades than those of gravel, *e.g.*, having a majority of the pebbles of larger size than a walnut.

Shonkinite, *Pirsson*, 1895.—A melanocratic and generally felspathoidal syenite or monzonite composed of orthoclase, plagioclase and pyroxene, with a small and variable amount of nepheline.

(Shonkin Sag, Montana.)

W. H. Weed & L. V. Pirsson: *Bull. Geol. Soc. Am.*, 6, 1895, p. 415.

G. W. Tyrrell: *Trans. Roy. Soc. Edin.*, li, 1915, p. 552.

Shoshonite, *Iddings*, 1895.—A mafic variety of olivine-trachydolerite, containing orthoclase-mantled labradorite; associated with *absarokite* and *banakite*. (Shoshone R., Yellowstone Park.)

J. P. Iddings: *Journ. Geol.*, iii, 1895, p. 943.

— *U.S.G.S., Mon.* xxxii (ii), 1899, p. 339.

Siderite. — A general term for meteoric irons, composed almost wholly of nickel-iron, including hexahedrites, octahedrites, and ataxites.

Siderolite. *Maskelyne*, 1863. — A general term for stony-iron meteorites which contain large proportions of both silicates and nickel-iron. The silicate minerals include bronzite and olivine, and, in small amount, anorthite. Brezina has restricted the term to include only the mesosiderites, lodranite, and grahamite. Cf. *Lithosiderite*.

Siderophyre, *Tschermak*, 1883.—A siderolite containing crystals of bronzite and asmanite (tridymite) in a network of nickel-iron.

Sieve Texture.—A texture of metamorphic rocks due to the occurrence of abundant inclusions in larger spongy crystals; = *Diablastic*.

Silcrete. *Lamplugh*, 1902. — A term suggested for conglomerates formed by the cementation of superficial gravels by silica.

G. W. Lamplugh: *Geol. Mag.*, 1902, p. 575.

Silex.—=*Flint*.

Silexite, *Miller,* 1919.—A term proposed for any body of pure or nearly pure silica of igneous or aqueo-igneous origin, which occurs as a dyke, segregation mass, or cognate inclusion.

W. J. Miller : *Journ. Geol.,* xxvii, 1919, p. 30.

Siliceous Sinter.—A solution-deposit of silica formed from the waters of geysers and other thermal springs.

W. H. Weed : *U.S.G.S. 9th Ann. Rep.,* 1887-8, 1890, p. 619.

Sill.—A tabular sheet of igneous rock injected along the bedding planes of sedimentary or volcanic formations ; = *Intrusive sheet.*

Siltstone, *Green.*—A very fine-grained sandstone, the particles of which are predominantly of *silt* grade.

Sismondinite, *Franchi,* 1897.—A schist having sismondine as its predominant mineral.

Sivamalai Series, *Holland,* 1901.—A series of igneous rocks occurring in Madras, produced by the differentiation of a highly aluminous and alkaline magma ; the chief rock types being nepheline-augite-, and corundum-syenites and siliceous pegmatites.

(Sivamalai, Coimbatore district, Madras.)

T. H. Holland : *Mem. Geol. Surv. India,* xxx, 1901, p. 160.

Skarn.—An old Swedish mining term for the silicate gangue (amphibole, pyroxene, garnet, etc.) of certain iron-ore and sulphide deposits of Archæan age, particularly those which have replaced limestone and dolomite. The term is used in this sense by Fennoscandian geologists, but it has been extended to cover analogous products of contact metamorphism in younger formations.

V. Goldschmidt : *Die Kontaktmetamorphose im Kristianiagebiet,* 1911.

P. Eskola : *Bull. Comm. Géol. Finlande,* No. 40, 1914, p. 225

Skleropelite, *Salomon,* 1915. — A term proposed for argillaceous and allied rocks which have been indurated by low-grade metamorphism. The type is more dense and massive than shale, and differs from slate in the absence of cleavage.

W. Salomon : *Geol. Rund.,* vi, 1915, p. 404.

Skomerite, *Thomas,* 1911.—A volcanic rock, containing phenocrysts of augite and albite-oligoclase, with less abundant olivine, in a felted groundmass, consisting predominantly of albite.

(Skomer I., Pembroke.)

H. H. Thomas: *Q.J.G.S.*, lxvii, 1911, p. 175.

Slate.—A general term for compact aphanitic rocks formed from fine-grained deposits such as shales, mudstones, or volcanic ashes, having the property of easy fissibility along planes independent of the original bedding, whereby they can be parted into thin plates indistinguishable from one another in lithological characters.

W. M. Hutchings: *Geol. Mag.*, 1890, pp. 264, 316; 1891, p. 164; 1892, pp. 154, 218; 1894, pp. 36, 64.

Soda-.—A prefix added to the names of igneous rocks to indicate that they contain soda-pyroxenes and/or soda-amphiboles; *e.g.*, *soda-rhyolite*, *soda-trachyte*, *soda-granite*, etc.

Sodalitite. *Ussing,* 1911.—A phanerocrystalline rock, composed essentially of sodalite, with small amounts of ægirine, eudialyte, and alkali-felspar.

N. V. Ussing: *Medd. om Grönland*, xxxviii, 1911.

Soggendalite. *Kolderup*, 1896. — A melanocratic dolerite rich in pyroxene.

(Soggendal, Norway.)

C. F. Kolderup: *Bergens Mus. Aarb.*, 1896, p. 150.

Sol.—A homogeneous suspension of colloidal matter in a liquid. See *Colloid.*

Solfataric. — A term applied to a "dormant" or "decadent" stage of volcanic activity characterised by the emission at the surface of gases and vapours of volatile substances.

F. W. Clarke: *U.S.G.S. Bull.* 616 (*Data of Geochemistry*), 1916. p. 260.

Solid Solution.—A crystalline and homogeneous solid, representing a mixture of two or more substances, and often, though not necessarily, composed of isomorphous compounds. The proportions of such a mixture can change within certain critical limits without destroying the homo-

geneity. Many of the common igneous rock-forming minerals are complex solid solutions, *e.g.*, felspars, pyroxenes and amphiboles; whereas minerals formed by the action of shearing stress in rocks undergoing metamorphism are generally of less complex constitution.

Sölvsbergite, *Brögger*, 1894. — A fine-grained holocrystalline rock with trachytic texture, consisting of alkali-felspars with soda-pyroxenes and amphiboles. The rock is richer in mafic minerals than bostonite and differs from grorudite by the absence of quartz. (Sölvsberg, Norway.)

W. C. Brögger: *Eruptivgest. Kristiania*, 1, 1894, p. 67.

Sommaite, *Lacroix*, 1905.—A monzonitic rock occurring as ejected blocks, containing bytownite, orthoclase, augite and olivine, and occasionally in small amount, leucite. Chemically the rock corresponds with ottajanite.

(Mte. Somma, Vesuvius.)

A. Lacroix: *C.R.*, cxli, 1905, p. 1188.

Sondalite, *Stache & von John*, 1877.—A metamorphic rock composed of cordierite, quartz, garnet, tourmaline and kyanite.

Sonstadt Solution.—See **Thoulet Solution.**

Sordawalite, *Nordenskiold*, 1820.—A name given to the vitreous selvage of a dyke of olivine-dolerite; = *Wichtisite*, = *Tachylyte*.

(Sordawala, L. Ladoga, Finland.)

Soret Principle.—A thermo-dynamic principle, stating that if the temperature varies from point to point in any dilute solution, the concentration of the solute also varies, and in such a way that equilibrium is only established when the concentration is everywhere proportional to the absolute temperature.

Sparagmite. — A collective term for the late Pre-Cambrian or Jotnian Scandinavian rocks, which, like those of the Torridonian of Scotland, comprise polygenetic conglomerates, felspathic grits, arkose, and graywacké.

Specific Gravity. — The ratio of the mass of any quantity of a substance to the mass of an equal volume of some standard substance. In the case of solids and liquids the latter is chosen as water at 4° C. Cf. *Density*.

A. Holmes: *Petrographic Methods and Calculations*, 1920.

Specific Heat.—The quantity of heat necessary to raise the temperature of one gram of a given substance by 1° C.

K. Schulz: *Fort. der Min. Krist. Pet.*, ii, 1912, p. 259; 1913, p. 273.

W. P. White: *Am. Journ. Sci.*, xlvii, 1919, pp. 1, 44.

Sperone. — A porous variety of leucitite containing small crystals of melanite.

Spessartite, *Rosenbusch*, 1895.—A diorite-lamprophyre consisting essentially of green hornblende and plagioclase. The name is also used for garnets which approximate in composition to $Mn_3Al_2(SiO_4)_3$. (Spessart.)

Sphenolith, *Burckhardt*, 1906.—An injected igneous intrusion having an approximately wedge-shaped form.

C. Burckhardt: *Cong. Géol. Inter. Guide*, 26 (Mexico), 1906, p. 33.

Spheroidal.—*See* **Orbicular.**

Spheroidal Parting.—A structure due to uniform contraction during cooling produced in igneous rocks of fine homogeneous grain, and occurring as a series of concentric spheroidal or ellipsoidal cracks about compact nuclei. Each set of cracks is more strongly developed during weathering, the successive shells so produced resembling the layers of an onion, and varying in diameter from an inch or two to several feet.

Spherulite, *Vogelsang*, 1872.—A radiating and often concentrically arranged aggregation of one or more minerals, in outward form approximating to a spheroid, and due to the radial growth of prismatic or acicular crystals in a viscous magma or rigid glass about a common centre or inclusion.

The spherulitic body itself is said to have a *radial* or *concentric texture,* while the rock, which may be hemicrystalline, devitrified, or still glassy, is said to have a *spherulitic structure.*

F. E. Wright: *Bull. Geol. Soc. Am.,* xxvi, 1915, p. 255.

Spherulitic Structure.—A structure in which spherulites are distributed through an igneous rock or groundmass.

W. Cross: *Bull. Phil. Soc. Wash.,* xi, 1891, p. 411.
J. P. Iddings: *Bull. Phil. Soc. Wash.,* xi, 1891, p. 445.
L. V. Pirsson: *Am. J. Sci.,* xxx, 1910, p. 97.

Spiculite, *Rutley,* 1891.—A spindle-shaped crystallite considered to represent the coalescence of a linear series of globulites; = *Belonite.*

F. Rutley: *Min. Mag.,* ix, 1891, p. 263.

Spilite, *Brongniart,* 1827.—A basaltic rock, generally vesicular or amygdaloidal, whose felspars have been albitised. Pyroxene or amphibole, more or less altered, and sometimes serpentinised olivine may be present.

Spilitic Suite, *Dewey & Flett,* 1911. — A suite of igneous rocks, comprising extrusions and minor intrusions, characterised throughout by an abundance of soda-felspar, and by the prevalence of albitisation; named after *spilite,* the type member of the suite.

H. Dewey & J. S. Flett: *Geol. Mag.,* 1911, p. 202.
J. A. Thomson: *Q.J.G.S.,* lxix, 1913, p. 665.
A. H. Cox: *Rep. Brit. Assoc.* (Birmingham, 1913), 1914, p. 496.

Spilosite, *Zincken,* 1841.—A contact metamorphosed shale or slate, having a maculose structure, due to the presence of aggregates of cryptocrystalline matter rich in iron-oxides, in a streaked matrix of sericite and chlorite and minute grains of quartz.

H. Dewey: *Trans. Roy. Geol. Soc. Cornwall,* xv, 1915, p. 71.

Spotted Slates or **Spotted Schists.** — In argillaceous rocks, altered by contact metamorphism of low to moderate intensity, metamorphic diffusion and dif-

ferentiation about numerous centres effect partial reconstitution convergent towards, but not necessarily attaining to definite minerals. Arrested development may be recorded in concretionary spots of imperfectly individualised minerals (such as andalusite, cordierite, mica or chloritoid) in a felted base composed largely of sericitic matter. For varieties of such spotted rocks there are no special terms in British nomenclature, the following German terms having been widely adopted :—

Fleckschiefer.—Characterised by minute flecks or spots of indeterminate material.

Fruchtschiefer. — Characterised by concretionary spots suggestive of grains of wheat.

Garbenschiefer. — Characterised by concretionary spots suggestive of carraway seeds.

Knotenschiefer.—Characterised by conspicuous subspherical or polyhedral clots often composed of definitely individualised minerals.

All these types are allied to and pass into ordinary varieties of hornfels and schist. Cf. *Maculose.*

Stalactite.—A pendant concretionary deposit of calcium carbonate formed from percolating solutions in icicle-like masses on the roofs of limestone caverns and in other analogous situations.

Stalagmite.—A concretionary deposit of calcium carbonate formed from dripping solutions on the floors and walls of limestone caverns, and in other analogous situations.

Static Metamorphism, *Judd,* 1889. — A variety of regional metamorphism brought about by the action of heat and solvents at high pressures, the latter being due to a superincumbent load, and not induced by orogenic deformation.

R. A. Daly : *Bull. Geol. Soc. Am.,* 23, 1917, p. 397.

Staurotile, *Cordier,* 1868. — A variety of mica-schist characterised by porphyroblastic crystals of staurolite, often accompanied by garnet.

Stockwork.—A mineral deposit, consisting of a system of small reticulated veins (forming a complicated network) traversing the country rock.

Strain-shadows.—A general term for the undulatory extinction seen in homogeneous minerals, such as quartz, indicating a modification of the normal optical properties due to strain. The phenomenon is commonly seen in cataclastic rocks, and must not be confused with the partial extinction of zoned crystals.

Strain-slip Cleavage.—A variety of cleavage occurring in certain low-grade metamorphic rocks, due to differential movement or "slip" along each of a nearly parallel series of closely-packed shear-planes. Between each pair of shear-planes the rocks are puckered into sigmoidal microscopic folds, the outer limbs of which merge tangentially into the shear-planes.

T. G. Bonney: *Q.J.G.S.*, xlii, 1886, p. 95.

Streaky Structure.—A term denoting the presence in rhyolitic and allied rocks of numerous dark films or lenticular veinlets, arranged parallel, or nearly so, to the flow-surfaces, and containing minerals such as quartz, pyrite, chlorite, sericite, carbonates, epidote, and sometimes garnet. Typically developed in the Lake District, the "streaks" are considered to be due to deposition in and around contraction cracks from infiltrating solutions under high pressure during the solfataric stage of the Borrowdale vulcanism.

J. F. N. Green: *Min. Mag.*, xvii, 1915, p. 207.

Stress Minerals, *Harker*, 1918. — A term suggested for minerals such as chlorite, chloritoid, talc, albite, epidote, amphiboles, kyanite, etc., whose formation in metamorphosed rocks is favoured by shearing-stress; contrasted with *anti-stress minerals* (*q.v.*).

A. Harker: *Q.J.G.S.*, lxxiv, 1918, p. lxxvii.

Stromatolithic, *Foye*, 1916. — A term, meaning "stone layer," applied to the banded structure of

composite gneisses which consist of alternating layers of igneous and schistose rocks in sill relationship.

W. G. Foye: *Journ. Geol.*, xxiv, 1916, p. 783.

Stronalite.—A name given to the cataclastic biotite-gneisses associated at Strona with diorite-gneiss and kinzigite. (Strona, Ivrée, W. Alps.)

Structure. — A term applied (*a*) to the morphological features of rocks due to fracture, *e.g.*, *columnar* structure, *perlitic* structure; and (*b*) to the appearance of a heterogeneous rock in which the *textures* or *composition* of neighbouring parts differ from one another, *e.g.*, *spherulitic* structure, *orbicular* structure, *bedded* structure, *gneissose* structure, *banded* structure.

SEDIMENTS: H. C. Sorby: *Q.J.G.S.*, lxiv, 1908, p. 171.
A. C. Trowbridge: *Journ. Geol.*, xxii, 1914, p. 420.
B. Smith: *Geol. Mag.*, 1916, p. 146.
E. M. Kindle: *Geol. Mag.*, 1916, p. 542.

IGNEOUS ROCKS: R. B. Sosman: *Journ. Geol.*, xxiv, 1916, p. 215.
F. F. Grout: *Journ. Geol.*, xxvi, 1918, p. 439.

METAMORPHIC ROCKS: U. Grubenmann: *Fort. der Min. Krist. u. Pet.*, ii, 1912, p. 208.

Stubachite, *Weinschenk*, 1891.—An altered diallage-peridotite containing tremolite, talc, serpentine, magnetite, pyrite and breunnerite in variable amounts. By increase of serpentine the type passes into *stubachite-serpentine*.

(Stubachtale, Tyrol.)

Stylolites.—A term applied to parts of certain limestones which have a column-like development; the "columns" being generally at right-angles or highly inclined to the bedding planes, having grooved, sutured or striated sides, and irregular cross sections.

G. H. Gordon: *Journ. Geol.*, xxvi, 1918, p. 561.

Subhedral.—See **Hypidiomorphic.**

Sub-rang, *C.I.P.W.*, 1902.—A division of rangs (*q.v.*) based (in Classes I., II. and III.) on the

relative proportions of the molecules of salic K_2O to salic Na_2O, roughly corresponding to the division of rocks based on the proportions of orthoclase and leucite to those of albite and soda-felspathoids. In Classes IV. and V. the sub-rangs are based on the relative proportions of MgO to FeO.

Subsilicic, *Clarke*, 1911.—A term suggested in place of "basic" to connote that the rocks so described have a silica-content less than 52 per cent.

Sudburite, *Coleman*, 1912.—A variety of basalt, often amygdaloidal and characterised by pillow structure, and in places somewhat sheared and metamorphosed, consisting essentially, when fresh, of bytownite, hypersthene, augite and magnetite (15-20 per cent.). The type is regarded as the effusive equivalent of norite and may be uniformly fine-grained or porphyritic. (Sudbury, Ontario.)

A. P. Coleman: *Ontario Bur. Mines, 23rd Ann. Rep.*, xxiii, 1914, p. 215.

Suldenite, *Stache & John*, 1879.—A variety of hornblende-andesite differing from ortlerite in having an andesitic rather than a microdioritic groundmass. (Mte. Confinale, Tyrol.)

Sussexite, *Kemp*, 1892. — A nepheline-porphyry, consisting essentially of nepheline and ægirine; a tinguaite-like rock, free from essential felspar. Cf. *nephelinite* and *urtite*.

(Sussex Co., New Jersey.)

Sutured Texture.—A texture of granulose metamorphic rocks, in which the individual grains meet in irregular interlocking contacts.

Syenite, *Pliny*. — A term originally applied to hornblende-granite, now connoting a phanerocrystalline rock composed essentially of alkali-felspars, and one or more of the common mafic minerals, hornblende being especially characteristic. When quartz is present the term *quartz-syenite* is used. With increase in soda-lime-felspars relative to

orthoclase, the rock passes from syenite through syenodiorite to diorite, or through monzonite to gabbro. The rock of Syene, Egypt, is a red hornblende-granite; the type *syenite* is that of Dresden (*Plauenite*).

H. S. Washington: *Am. Journ. Sci.*, xxii, 1906, p. 132.

Syenodiorite, *Evans*, 1916.—A term based on the form of *granodiorite* for rocks like the latter, but free from quartz, *i.e.*, for phanerocrystalline igneous rocks intermediate in composition between syenite and diorite. Rocks of this kind have generally been called *monzonite,* a term which should, however, be restricted to types intermediate between syenite and gabbro. = *Monzodiorite.*

Syenogabbro, *Johannsen,* 1917. — A term suggested for quartz-free *granogabbro*, *i.e.*, for phanerocrystalline igneous rocks intermediate in composition between labradorite-monzonite and gabbro.

Symplektite, *Lœwinson-Lessing,* 1897.—A secondary intergrowth of two minerals which are interwoven or plaited together, one of the minerals having often a vermicular habit. The texture so produced is described as *symplektitic,* and is found in certain igneous and thermally-metamorphosed rocks.

J. J. Sederholm: *Bull. Comm. Géol. Finlande,* No. 48, 1916.

Synantetic, *Sederholm*, 1916. — A term applied to minerals formed between two other minerals by interaction between the latter; as in coronas, kelyphitic borders, reaction rims, etc.

J. J. Sederholm: *Bull. Comm. Géol. Finlande,* No. 48, 1916.

Syngenetic. — A term now generally applied to ore-deposits formed contemporaneously with the enclosing rocks, contrasting them with *epigenetic* deposits of later origin than the enclosing rocks.

Syntectic, *Lœwinson-Lessing,* 1899.—A term applied to magmas produced by syntexis, and also used substantively to connote the magmas themselves.

R. A. Daly: *Igneous Rocks and their Origin,* 1914, p. 312.

Syntexis, *Lœwinson-Lessing*, 1899.—The sum of the processes whereby magmas are generated or augmented owing to the remelting or assimilation of portions of the lithosphere which comprise different classes of rocks. The term is thus of broader scope than *anatexis*, which implies refusion of a portion of the crust consisting predominantly of one type of rock, such as granite.

F. Lœwinson-Lessing : *Geol. Mag.*, 1911, p. 297.

System.—A term applied to the sum of the phases that can be formed from one, two (binary system), three (ternary system), or more components under different conditions of temperature, pressure and composition. Systems, or parts of systems, are described, as shown below, in terms of their components.

Plagioclase, Albite-Anorthite :—A. L. Day & E. T. Allen : *Am. Journ. Sci.*, xix, 1905, p. 93.

—— N. L. Bowen : *Am. Journ. Sci.*, xxxv, 1913, p. 577.

Forsterite-Silica :—N. L. Bowen & O. Andersen : *Am. Journ. Sci.*, xxxvii, 1914, p. 487.

Diopside-Albite-Anorthite :—N. L. Bowen : *Am. Journ. Sci.*, xxxviii, 1914, p. 222.

Anorthite-Forsterite-Silica :—O. Andersen : *Am. Journ. Sci.*, xxxix, 1915, p. 407.

Diopside-Albite-Anorthite :—N. L. Bowen : *Am. Journ. Sci.*, xl, 1915, p. 161.

$CaO—Al_2O_3—SiO_2$:—G. A. Rankin & F. E. Wright : *Am. Journ. Sci.*, xxxix, 1915, p. 1.

General :—N. L. Bowen : *Journ. Geol. Supp. Vol.*, xxiii, 1915.

$CaO—Al_2O_3—MgO$:—G. A. Rankin & H. E. Merwin : *Journ. Am. Chem. Soc.*, xxxviii, 1916, p. 568.

$Fe_2O_3—Fe_3O_4$:—R. B. Sosman & J. C. Hostetter : *Journ. Am. Chem. Soc.*, xxxviii, 1916, p. 807.

$CaCO_3$:—J. Johnston *et aliter* : *Am. Journ. Sci.*, xli, 1916, p. 473.

Nepheline : $NaAlSiO_4—KAlSiO_4$:—N. L. Bowen : *Am. Journ. Sci.*, xliii, 1917, p. 115.

$H_2O—K_2SiO_3—SiO_2$:—G. W. Morey : *Journ. Am. Chem. Soc.*, xxxix, 1917, p. 1173.

$MgO—Al_2O_3—SiO_2$:—G. A. Rankin & H. E. Merwin : *Am. Journ. Sci.*, xlv, 1918, p. 301.

$CaO—MgO—SiO_2$: J. B. Ferguson & H. E. Merwin : *Am. Journ. Sci.*, xlviii, 1919, p. 165.

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Tachylyte, *Breithaupt,* 1826.—A black compact glassy rock of lustrous basaltic composition, generally occurring as a chilled selvage in dykes and sills, but in Hawaii exceptionally forming the bulk of certain lava flows.

G. A. J. Cole: *Q.J.G.S.,* xliv, 1888, p. 300.
A. Harker: *Mem. Geol. Surv. Scot.* (Small Isles), 1908, p. 155.

Taconite.—A term used in the Lake Superior district for ferruginous cherts of Animikian age. The rocks so designated are of various tints, and may be finely granular, banded, or brecciated. They represent a complete replacement of greenalite-rock (*q.v.*) by silica, iron-ores, and ferruginous amphiboles.

C. R. Van Hise & C. K. Leith: *U.S.G.S., Mon.* lii, 1911, pp. 181, 468.

Tactite, *Hess,* 1919. — A general term suggested for rocks of complex mineral composition formed by the contact metamorphism of limestone, dolomite, and other carbonate rocks, and into which foreign matter from the intrusion has been introduced by hot solutions. Rocks of the enclosing zone, such as tremolite- and wollastonite-marbles, are not covered by the term.

F. L. Hess: *Am. Journ. Sci.,* xlviii, 1919, p. 377.

Tahitite, *Lacroix,* 1917. — A variety of felspathoidal trachyandesite containing phenocrysts of hauyne. The rock is a microlitic form of the nepheline-monzonite with which it is associated in the type-locality. (Tahiti, Pacific.)

A. Lacroix: *C.R.,* clxiv, 1917, p. 581.

Taimyrite, *Chrouschoff,* 1892. — A variety of soda-trachyte characterised by the presence of actual or occult quartz, and regarded as the effusive equivalent of nordmarkite.

Talc-schist.—A schist in which talc, generally associated with mica and quartz, is the dominant schistose mineral.

Tamaraite, *Lacroix*, 1918.—A melanocratic dyke rock, containing augite and barkevikite as the chief mafic minerals, and nepheline, or analcite, as the chief felsic constituent; in addition small amounts of orthoclase or plagioclase may be present. The type is thus a lamprophyric facies of nepheline-basalt. (Los Archipelago.)

A. Lacroix: *C.R.*, clxvi, 1918, p. 543.

Taraspite.—A mottled variety of compact dolomite of Jurassic age, used for decorative purposes. (Tarasp, Switzerland.)

Taurite, *Lagorio*, 1897.—A soda-rhyolite characterised by the presence of ægirine, and differing from comendite in having a spherulitic or micro-granophyric groundmass. (Near Sebastopol, Crimea.)

Tavolatite, *Washington*, 1908. — A leucite-rich volcanic rock, containing large phenocrysts of leucite in a groundmass of leucite, hauyne, and augite with small amounts of orthoclase, labradorite and garnet. Intermediate between leucitite on the one hand, and leucite-trachyte or tephrite on the other. (Tavolato, Roman district.)

H. S. Washington: *Carnegie Inst. Wash., Pub. No.* 57, 1906, p. 50.

Tawite, *Ramsay*, 1894. — A phanerocrystalline rock composed essentially of sodalite and ægirine. With the incoming of alkali-felspar the rock passes through felspathic-tawite to sodalite-syenite. Porphyritic rocks of the same composition are known as *Tawite-porphyry*. (Kola Peninsula.)

Taxite, *Lœwinson-Lessing*, 1891.—A general term for volcanic rocks of clastic appearance owing to the consolidation and aggregation of more than one kind of product from the same flow. When the different consolidation products are disposed in alternating bands the resulting rock is described as

eutaxite, and the structure as *eutaxitic*. When the aggregation resembles a breccia, the rock is described as *ataxite*, and the structure as *ataxitic*.

F. Lœwinson-Lessing : *Bull. Soc. Belge Géol.*, v, 1891, p. 104.

Tectonite, *Backlund*, 1918.—A mylonitic rock formed from crystalline schists of sedimentary origin and in part again recrystallised. Cf. *Protomylonite*.

H. G. Backlund : *Geol. För. Förh.*, xl, 1918, p. 198.

Tektite, *Suess*, 1900.—A group term suggested for moldavites, billitonites, australites, and queenstownites, in place of the term *obsidianite* proposed by Walcott.

F. E. Suess : *Mitt. Geol. Ges. Wien*, vii, 1914, p. 54.
F. P. Mueller : *Geol. Mag.*, 1915, p. 206.

Tephrite, *Cordier*, 1816. — A basaltic rock containing plagioclase and nepheline or other soda-felspathoid. With the addition of olivine the rock becomes basanite.

Tephritoid, *Bücking*. — A rock having the chemical composition of a tephrite, but containing a soda-rich glassy base in place of nepheline. Cf. *Basanitoid*.

Terra rossa.—A red ferruginous earth formed as a residual product during the subserial denudation of limestones, the type area of its occurrence being the Karst lands of the Adriatic.

Teschenite, *Hohenegger*, 1861.—An alkali-rich variety of analcite-dolerite characterised by the presence of idiomorphic purple augite or ægirine-augite, and generally containing soda-amphiboles such as barkevikite. (Teschen, Bohemia.)

G. W. Tyrrell : *Q.J.G.S.*, lxxii, 1917, p. 84.
Mem. Geol. Surv. Scot. (East Lothian), 1910, p. 114.

Texture.—The appearance, megascopic or microscopic, seen on a smooth surface of a homogeneous rock or mineral aggregate, due to the degree of crystallisation (*crystallinity*), the size of the crystals

(*granularity*), and the shapes and interrelations of the crystals or other constituents (*fabric*).

J. E. Spurr : *Journ. Geol.*, ix, 1901, p. 586.
C.I.P.W. : *Journ. Geol.*, xiv, 1906, p. 692.
L. Milch : *Fort. der Min. Krist. u. Pet.*, ii, 1912, p. 163.
U. Grubenmann : *Fort. der Min. Krist. u. Pet.*, ii, 1912, p. 208.

Theralite, *Rosenbusch,* 1887. — A phanerocrystalline rock composed essentially of labradorite, nepheline and purple augite, and often containing soda-amphiboles and biotite, or both. Analcite may be present, and most examples are olivine bearing. (Duppau, Bohemia.)

G. W. Tyrrell : *Geol. Mag.*, 1912, p. 79.
A. Lacroix : *C.R.*, clxx, 1920, p. 20; *Geol. Mag.*, 1920, p. 185.

Thermal Metamorphism. — A variety of metamorphism in which recrystallisation is due to high temperature, the latter not being a consequence of dynamic processes, or of the introduction of magmatic emanations.

For References see under **Metamorphism.**

Thin Sections.—Flakes or slices of a rock or mineral which have been ground down until their thickness is reduced to nearly a thousandth of an inch, and mounted on object-glasses for microscopic investigation. For most purposes the thickness of the finished section should be about 30 microns (30 μ=0.03 mm.).

H. J. Grayson : *Proc. Roy. Soc. Victoria,* xxiii, 1910, p. 65.
G. F. H. Smith : *Min. Mag.*, xvi, 1913, p. 317.
A. Holmes : *Petrographic Methods and Calculations*, 1920.

Tholeiite, *Steininger,* 1840.—A term applied to porphyritic basalts characterised by the presence of phenocrysts of labradorite or bytownite in an intersertal groundmass containing glass and occult free silica. (Tholei Schaumberg.)

G. W. Tyrrell : *Geol. Mag.*, 1917, p. 350.

Thoulet Solution.—A yellowish green transparent aqueous solution of potassium mercuric iodide, having a maximum specific gravity of 3.19. Also known as *Sonstadt Solution.*

Tilaite, *Duparc & Pearce,* 1905. — A melanocratic variety of olivine-gabbro or olivine-eucrite containing pyroxenes and olivine with subordinate felspar (bytownite to anorthite) and small amounts of hornblende, biotite, apatite and magnetite.

(Tilai Kamen, N. Urals.)

L. Duparc & P. Pamfil: *Bull. Soc. Min. France,* xxxiii, 1910, p. 358.

Tillite, *Penck.* — A term applied to consolidated boulder-clays formed during glacial epochs anterior to that of the Pleistocene.

A. P. Coleman: *Bull. Geol. Soc. Am.,* xix, p. 347.
—— *Smithson. Rep.* (1916), Pub. No. 2458, 1917, p. 264.

Timazite, *Breithaupt.*—A variety of greenstone containing white felspar, hornblende, and in some varieties quartz; considered to be an altered derivative from augite-dacite or augite-andesite.

Tinguaite, *Rosenbusch,* 1887. — A dyke rock, often porphyritic, having the composition of an ægirine-phonolite, and differing from sölvsbergite by the presence of nepheline.

(Serra de Tingua, Brazil.)

W. C. Brögger: *Eruptivgest. Kristiania,* 1, 1894, p. 109.

Tjosite, *Brögger,* 1898. — A porphyritic syenite-lamprophyre containing augite, olivine, apatite, and magnetite in a matrix of anorthoclase laths. Cf. *Kvellite.* (Kirchspiel Tjose, Laurvik.)

Toadstone.—An old local name for the contemporaneous amygdaloidal basalts of the Carboniferous Limestone of Derbyshire. The name either suggests a resemblance between the amygdales and the spots of a toad's skin, or is an anglicised variant of *todtstein,* in reference to the absence of lead ore.

H. H. Arnold-Bemrose: *Q.J.G.S.,* lxiii, 1907, p. 241.

Toellite, *Pichler,* 1873.—A variety of porphyrite containing phenocrysts of biotite, hornblende, and garnet with some of andesine and quartz, in a microgranophyric groundmass; = *Töllite.*

(Toell, Tyrol.)

Tonalite, *v. Rath*, 1864.—A quartz-diorite containing hornblende and biotite as the chief mafic minerals.
(Tonale, Tyrol.)

Tönsbergite, *Brögger*, 1890. — A red laurvikite-like rock, in which the felspars are orthoclase and andesine. Some varieties are porphyritic.
(Tönsberg, S. Norway.)

Topazoseme, *Haüy*, 1822.—A rock composed essentially of topaz, quartz, and tourmaline.

Topsailite, *Lacroix*, 1911.—A lamprophyric rock (intermediate in type between camptonite and kersantite), containing phenocrysts of plagioclase (about An_{50}), augite, apatite, and titanoferrite, in a groundmass composed of andesine, biotite, barkevikite, augite and sphene.
(C. Topsail, Los Is.)
A. Lacroix: *Nouv. Arch. du Mus. de Hist. Nat.*, 5 (iii), 1911, p. 78.

Torbanite, *Liversidge*, 1881.—An extreme variety of oil-shale, containing some 70 to 80 per cent. of carbonaceous matter, including an abundance of spores. It is a dark-brown substance, having a dull lustre, a yellow-fawn streak and a low specific gravity—1.2 to 1.3.
Mem. Geol. Surv. Scot. (Oil Shales of the Lothians), 2nd Ed., 1912, p. 159.
H. R. J. Conacher: *Trans. Geol. Soc. Glasgow*, xvi, 1917, p. 164.

Tordrillite, *Spurr*, 1900.—A hololeucocratic variety of rhyolite, characterised by the absence of mafic minerals, and corresponding chemically to alaskite.
(Tordrillo Mts., Alaska.)

Toscanite, *Washington*, 1897.—A variety of quartz-trachyandesite; *i.e.*, a volcanic rock intermediate in its characters between rhyolite and dacite.
(Tuscany, Italy.)
H. S. Washington: *Journ. Geol.*, v, 1897, p. 37.

Tourmaline-corundum Rocks, *Scrivenor*, 1910.—Very hard and fine-grained rocks of blue-black colour, having the mineral composition indicated

by their name. Under the microscope they show oolitic structure, indicating that they are probably due to the intense metamorphism of oolitic cherts by granite. (Kinta, Malay States.)

J. B. Scrivenor: *Q.J.G.S.*, lxvi, 1910, p. 435.
W. R. Jones: *Q.J.G.S.*, lxxii, 1916-17, p. 178.

Tourmalinisation.—A term applied to the processes, late-magmatic or pneumatolytic, whereby pre-existing minerals or rocks are replaced wholly or in part by tourmaline.

J. S. Flett: *Mem. Geol. Surv.* 347 (Bodmin and St. Austell), 1909, p. 65.
C. E. Tilley: *Trans. Roy. Soc., S. Australia*, xliii, 1919, p. 156.

Trachyandesite, *Michel-Lévy*, 1894.—A general term for rocks intermediate between trachyte and andesite, and generally containing phenocrysts of oligoclase or andesine in a trachytic groundmass, the felspar microlites of which are potash varieties.

H. S. Washington: *Journ. Geol.*, v, 1897, p. 367.

Trachybasalt, *Boricky*, 1873.—=*Tephrite* (in part), = *monchiquite* (in part).

Trachydolerite, *Abich*, 1841. — A general term for trachytic rocks containing labradorite in addition to orthoclase, or basaltic rocks containing orthoclase in addition to labradorite; *i.e.*, for rocks intermediate in character between trachyte and basalt.

H. S. Washington: *Journ. Geol.*, v, 1897, p. 350.

Trachyte, *Brongniart*, 1813. — An aphanitic volcanic rock, generally porphyritic, containing alkali-felspars, and one or more mafic minerals, of which biotite and augite are those most usually occurring.

G. W. Tyrrell: *Proc. Roy. Soc. Edin.*, xxxvi, 1917, p. 288.
Mem. Geol. Surv. Scot. (East Lothian), 1910, p. 127.

Trachytic Texture.—A texture in which neighbouring felspar laths of a microlitic groundmass have a sub-parallel disposition, corresponding to the

stream lines of the nearly consolidated lava or magma.

Trachytoid Phonolite.—A general term for varieties of nepheline-phonolite, containing preponderant alkali-felspars, and consequently having a trachytic texture; contrasted with *nephelinitoid phonolite* in which nepheline is the preponderant felsic mineral.

Trachytoid Texture. — A texture in which the prismatic felspars of a phanerocrystalline rock have a parallel or sub-parallel disposition, as for example in many varieties of alkali- and nepheline-syenites.

Traction, *Gilbert,* 1914. — A general term for that mode of transport of debris by running water, in which the particles are swept along close to the bed of the stream by rolling, sliding, or saltation; contrasted with *suspension.*

G. K. Gilbert: *U.S.G.S. Prof. Pap.*, 86, 1914, p. 15.

Trap. — An old Swedish name originally applied to igneous rocks which were neither coarsely crystalline, like granite, nor cellular and obviously volcanic, like pumice and scoria. The rocks so designated included basalts, dolerites, andesites, and porphyrites (types often grouped as *whinstones*); altered varieties of some of these, such as epidiorite and diabase (types grouped as *greenstones*); and, finally, the mica-traps or lamprophyres.

Trap-shotten Gneiss, *King & Foot,* 1864. — A term applied to gneiss impregnated with nearly black indurated material originally supposed to be injections of "trap" rock, but now identified with "flinty crush-rock." Cf. *Pseudo-tachylyte.*

T. H. Holland: *Mem. Geol. Surv. India,* xxviii, 1900, pp. 198, 248.

Trass. — A local Italian name applied to pumiceous tuffs which are utilised for the manufacture of hydraulic cement.

Travertine. — A variety of calcareous tufa, of light colour, often concretionary and compact, but vary-

ing considerably in structure, some varieties being extremely porous. Cf. *Onyx Marble*.

W. H. Weed : *U.S.G.S. 9th Ann. Rep.*, 1887-8, 1890, p. 619.

Trichite, *Zirkel*, 1873.—A thin filament or hair-like form of crystallite, often occurring in irregular or radiating groups.

F. Rutley : *Min. Mag.*, ix, 1891, p. 263.

Tripoli, *Wallerius*, 1747. — A fine powdery siliceous deposit composed of the tests of diatoms and radiolarians.

Troctolite, *v. Lasaulx*, 1875. — A phanerocrystalline rock composed essentially of labradorite or bytownite and olivine (always more or less serpentinised), with little or no augite. Cf. *Ossypite*.

T. G. Bonney : *Geol. Mag.*, 1885, p. 439.

J. S. Flett : *Mem. Geol. Surv.* 359 (Lizard), 1912, p. 85.

Trowlesworthite, *Worth*, 1884. — A pneumatolytic modification of granite containing orthoclase, tourmaline and fluorspar with residuary quartz.

(Trowlesworthy, Cornwall.)

Tsingtauite, *Koto*, 1909.—A variety of granite-porphyry having phenocrysts of orthoclase in a fine-grained granitic groundmass.

(Tsingtau, Korea.)

B. Koto : *Journ. Col. Sci. Tokyo*, xxvi, 1909, p. 186.

Tufa.—A porous, concretionary or compact formation of calcium carbonate deposited around springs.

Tuff.—A rock formed of compacted pyroclastic fragments, some of which can generally be distinguished as such by the naked eye. If the larger fragments exceed the size of walnuts the rock becomes an agglomerate, or a volcanic breccia. According as the prevalent constituents are fragments of crystals, rocks or glass, *crystal, lithic* and *vitric* types of tuffs are recognised. Cf. *Ash*.

L. V. Pirsson : *Am. Journ. Sci.*, xl, 1915, p. 191.

J. F. N. Green : *Proc. Geol. Assoc.*, xxx, 1919, p. 165.

Tuffite, *Mügge*, 1893.—A general term for composite clastic rocks, in which both volcanic (pyroclastic)

and detrital (epiclastic) materials are present in considerable amount.

Tusculite, *Cordier,* 1868. — A variety of melilite-leucitite containing only small amounts of pyroxene, ilmenite, and felspar.

(Tusculum, Italy.)

Typomorphic, *Becke.* — A term applied to minerals characteristic of the particular set of physical conditions which controlled their formation.

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Uintaite.—A black lustrous variety of bitumen having a conchoidal fracture, and thus resembling manjak. It differs from albertite by being completely soluble in turpentine, and, partly so, to the extent of 45 per cent., in alcohol; = *Gilsonite.*

(Uintah Co., Utah.)

G. H. Eldridge: *U.S.G.S. 22nd Ann. Rep.,* Pt. i, 1901, pp. 221, 340.

Ulrichite, *Marshall,* 1906.—A somewhat melanocratic variety of tinguaite containing large phenocrysts of alkali-felspars, nepheline, and soda-pyroxenes and amphiboles, with smaller phenocrysts of olivine and analcite.

P. Marshall: *Q.J.G.S.,* lxii, 1906, p. 397.
A. Holmes: *Geol. Mag.,* 1915, p. 366.

Ultrabasic Rocks, *Judd,* 1881. — A general term applied to igneous rocks containing little or no felspar, but characterised essentially by one or more of the common mafic minerals, such as olivine, pyroxenes, amphiboles, etc. Chemically, ultrabasic rocks have been described as those having a percentage of silica less than that of anorthite, the limiting figure being about 45 per cent.

Ultrametamorphism, *Holmquist,* 1909. — A general name for processes of so extreme a character that

the rocks affected pass wholly into a magmatic condition. Cf. *assimilation, anatexis, palingenesis, syntexis.*

Ultra-mylonite, *Quensel,* 1916.—A variety of mylonite in which primary structures and porphyroclasts have been entirely obliterated, so that the rock becomes homogeneous and aphanitic with little sign, if any, of parallel structure; = *Flinty crush-rock.* Cf. *Hartschiefer.*

P. Quensel: *Bull. Geol. Inst. Upsala,* xv, 1916, p. 103.

Umptekite, *Ramsay,* 1894.—A variety of alkali-syenite composed essentially of alkali-felspars and soda-amphiboles. (Umptek, Kola Peninsula.)

P. Quensel: *Bull. Geol. Inst. Upsala,* xii, 1914, p. 142.

Unakite, *Bradley,* 1874.—A variety of granite containing quartz, pink felspar and green epidote. (Unaka Range, N. Carolina.)

T. L. Watson: *Am. Journ. Sci.,* xxii, 1906, p. 248.

Uncompahgrite, *Larsen.*—A term applied to an extremely coarse-grained rock, containing 70 per cent. or more of melilite, with small amounts of pyroxene, magnetite, perovskite, and apatite. (Uncompahgre, Colorada.)

E. S. Larsen & J. F. Hunter: *Journ. Wash. Acad. Sci.,* iv. 1914, p. 473.

Undersaturated, *Shand,* 1913. — A term applied to rocks wholly or partly composed of unsaturated minerals; *e.g.*, felspathoids and olivine.

S. J. Shand: *Geol. Mag.,* 1913, p. 313; 1915, p. 340.
A. Holmes: *Geol. Mag.,* 1917, p. 124.

Unequal Pressure.—See **Directed Pressure.**

Ungaite, *Iddings,* 1913.—A general name suggested for oligoclase-dacites. (Unga Is., Kamchatka.)

Unsaturated, *Shand,* 1913.—A term applied to minerals (*e.g.*, felspathoids and olivine) which do not normally occur in association with free silica; also applied to rocks which contain only unsaturated minerals. (For references see *Undersaturated.*)

Uralitisation. — The processes whereby the primary pyroxene of igneous rocks is altered to *uralite*, a form of secondary hornblende paramorphic after augite, and generally, but not necessarily fibrous.

G. H. Williams : *U.S.G.S., Bull.* 62, 1890, p. 52.
L. Duparc & T. Hornung : *C.R.*, cxxxix, 1904, p. 223.

Urbainite, *Warren*, 1912.—A facies of ilmenitite containing from 10 to 20 per cent. of rutile, and from 3 to 5 per cent. of sapphirine.

(St. Urbain, Quebec.)

C. H. Warren : *Am. Journ. Sci.*, xxxiii, 1912, p. 275.

Ureilite, *Jerofejeff & Latschinoff*, 1888. — A coarse-grained achondritic meteorite composed of olivine and augite enclosed in a fine mesh of nickel-iron with carbonaceous matter (including diamond). The type is practically equivalent to a pallasite with less than 10 per cent. of nickel-iron.

Urtite, *Ramsay*, 1896. — A phanerocrystalline rock composed of nepheline (85 per cent.), ægirine (12 per cent.), and accessory apatite.

(Lujaur Urt, Kola, Finland.)

W. Ramsay : *Geol. Fören i Stockholm Förhandl.*, xviii, 1896, p. 463; *Fennia*, xv, 2, p. 22.

V

Vadose, *Posepny*, 1894. — A term applied to seepage waters occurring below the surface and above the water-table ; contrasted with *phreatic*, which refers to the ground-water below the water-table.

R. A. Daly : *Econ. Geol.*, xii, 1917, p. 494.

Valbellite, *von Schaever*, 1898.—A fine-grained variety of peridotite composed of olivine, hypersthene, and hornblende ; pyrrhotite is locally an abundant constituent ; = *Hornblende-harzburgite.*

(Val Bello, Piedmont.)

Vallevarite, *Gavelin*, 1915. — A somewhat leucocratic monzonitic rock composed largely of andesine-

microcline-antiperthite, with small amounts of diopside, biotite, titanoferrite and apatite.

(Vallevara, Sweden.)

A. Gavelin: *Geol. För. i Stockholm Förh.*, xxxvii, 1915, p. 19.

Van der Kolk Method. — A microscopic method for determining whether the refractive index of a mineral grain is higher or lower than that of a liquid medium in which it is immersed and viewed. Light rays from below the stage are cut off by inserting a suitable obstacle, and as the grain acts as a lens, and the eyepiece inverts the image, a shadow appears (*a*) on the same side as the when the grain has the higher refractive index, (*b*) on the opposite side when the grain has the lower index.

J. L. C. Schrœder van der Kolk: *Tabellen zur mikroscopischen Bestimmung der Mineralien nach ihrem Brechnungsindex.* Wiesbaden, 1906.

Variation Diagram. — A graphical representation of the variation in composition of the members of a series of related igneous rocks; *e.g.*, by plotting the bases as ordinates against silica as abscissæ.

A. Harker: *Nat. Hist. Ig. Rocks*, 1909, p. 119.
H. H. Robinson: *U.S.G.S. Prof. Pap.*, 76, 1913, figs. 32-5.
H. C. Richards: *Proc. Roy. Soc. Queensland*, 1916, p. 200.
A. Holmes: *Q.J.G.S.*, lxxii, 1916-17, p. 264.

Variolite, *Aldrovande*, 1648. — An aphanitic basaltic or andesitic rock containing numerous felspathic spherulites with radial texture (*varioles*).

G. A. J. Cole & J. W. Gregory: *Q.J.G.S.*, xlvi, 1890, p. 295.
G. W. Tyrrell: *Trans. Geol. Soc. Glasgow*, xiv, 1912, p. 291.

Variolitic Structure.—A structure akin to spherulitic structure occurring in basaltic rocks and especially in the tachylytic margins of small intrusions and in certain varieties of pillow-lavas known as variolites. In some cases the spherulites are made up of minute radiating fibres of plagioclase with interstitial glass, and in others they are less regular and consist of interferent sheaf-like groups of labra-

dorite rods diverted by grains of augite, olivine, or magnetite.

A. Harker : *Nat. Hist. Ig. Rocks*, 1909, p. 275.

Varnsingite, *Sobral,* 1913. — A coarse-grained dyke-rock essentially composed of albite and augite, with accessory sphene, apatite, and magnetite; regarded as a pegmatoid derivative from a gabbro magma. (Nordringa District, Sweden.)

Vaugnerite, *Fournet*, 1836.—A variety of quartziferous monzonite characterised by an unusual abundance of biotite and apatite. (Vaugneray, France.)

A. Lacroix : *Bull. Soc. franç. Min.*, xl, 1917, p. 158.

Vein. — An irregular sinuous igneous injection, or a tabular body of rock formed by deposition from solutions rich in water or other volatile substances.

Vein-quartz. — A rock of pegmatitic or hydrothermal origin consisting essentially of interlocking sutured crystals of quartz, the individuals varying widely in size.

Venanzite, *Sabatini,* 1898.—A holocrystalline porphyritic rock occurring as a lava flow, composed of phenocrysts of olivine and phlogopite in an aphanitic groundmass of these minerals, together with melilite, leucite and magnetite. Rosenbusch gave the name *Euktolite* to this rock, not knowing that it had already been described.

(San Venanzo, Umbria.)

Verite, *Osann,* 1889.—A black lamprophyric pitchstone containing crystals of phlogopite or biotite, augite, and olivine, with little or no modal felspar; the chemical composition is similar to that of the melanocratic trachytes and minettes.

(Vera, Cabo de Gata, Spain.)

Vermicular Quartz.—A term applied to quartz occurring in worm-like forms intergrown with or penetrating felspars; = *quartz de corrosion.*

J. J. Sederholm : *Bull. Comm. Geol. Finlande,* No. 48, 1916, p. 63.

Vesuvite, *Lacroix,* 1917.—A variety of leucite-tephrite rich in leucite. (Vesuvius.)

A. Lacroix: *C.R.,* clxv, 1917, p. 482.

Vicoite, *Iddings,* 1915.—A variety of leucite-tephrite characterised by the presence of orthoclase; = *leucite-shoshonite.* (Vico Volcano, Italy.)

J. P. Iddings & E. W. Morley: *Journ. Geol.,* xxiii, 1915, p. 234.

Vintlite, *Pichler,* 1875.—A porphyritic variety of hornblende-dolerite containing phenocrysts of labradorite or bytownite and brown hornblende in a fine-grained groundmass of felspar and hornblende, with a little quartz.

(Vintl, near Klausen, Tyrol.)

Viridite, *Vogelsang,* 1872. — A general term for obscure green alteration products (including chloritic minerals, serpentine, etc.), which cannot be, or have not been specifically diagnosed.

Viscosity. — Any resistance to deformation that involves dissipation of energy by internal friction.

Viscosity of Fluids.—The property of imperfect fluids whereby they resist the action of a shearing stress; measured by the shearing stress required to cause flow at a certain constant rate.

F. F. Grout: *Journ. Geol.,* xxvi, 1918, p. 485.

A. L. Field & P. H. Royster: *Trans. Am. Inst. Min. Eng.,* lviii, 1918, p. 658.

Viterbite, *Washington,* 1906. — A variety of leucite-trachyte containing abundant large phenocrysts of leucite. (Viterbo, Italy.)

H. S. Washington: *Carnegie Inst. Wash.,* Pub. No. 57 (*Roman Comagmatic Region*), 1906, p. 35.

Vitrain, *Stopes,* 1919. — A term suggested for the vitreous variety of " bright " coal. In bituminous coals it occurs as narrow, compact brilliant bands which break into small cube-like pieces or into irregular fragments with conchoidal fracture. The fine banding characteristic of *clarain* is not developed in vitrain, which, under the microscope,

is seen to be uniform and structureless, the colour in thin sections being from yellow to amber.

M. C. Stopes: *Proc. Roy. Soc. B.*, xc, 1919, p. 475.

Vitric Tuffs, *Pirsson,* 1915.—Volcanic tuffs or ashes mainly composed of comminuted fragments of glass. Cf. *lithic* and *crystal* tuffs.

L. V. Pirsson: *Am. Journ. Sci.*, xl, 1915, p. 191.

Vitro-.—A prefix added to the names of rocks to indicate the presence of abundant glass, *e.g.*, *Vitro-basalt*; = *hyalobasalt.*

Vitrophyre, *Vogelsang,* 1867. — A general term for porphyritic rocks having the composition of quartz-porphyry or orthophyre, but differing from these by the possession of a glassy groundmass.

Vogesite, *Rosenbusch,* 1887.—A syenitic lamprophyre of which the mafic minerals are generally hornblende, and sometimes augite, the dominant felspar being oligoclase or andesine when sufficiently fresh to be determined. (Vosges.)

W. Cross: *U.S.G.S., Prof. Pap.*, 90C, 1914, p. 21.

Volatile Fluxes, *Evans,* 1910.—A general term for the volatile constituents of magmas.

T. C. Chamberlain: *Carnegie Inst. Washington,* Pub. No. 106, 1908.

A. L. Day & E. S. Shephard: *Bull. Geol. Soc. Am.*, xxiv, 1913, p. 573.

Volcanic Dome. — A volcanic form consisting of rounded masses of viscous lava squeezed out from the orifice, or of portions of older lavas or ejectamenta elevated by the pressure of new lava rising from beneath. The term *dome* is also applied as a geographical term to volcanic mountains of the type of Mauna Loa.

A. Lacroix: *La montagne Pelée et ses éruptions*, 1906, p. 110; *La montagne Pelée après ses éruptions*, 1908, p. 31.

S. Powers: *Am. Journ. Sci.*, xlii, 1916, p. 261.

Volcanic Mud and Sand.—Deposits occurring around volcanic oceanic islands and coast-lines. The deposits near shore contain fragments of volcanic rocks and minerals, and are referred to as *sands*,

while further out the finer particles and alteration products form clayey or chloritic *muds*.

J. Murray & A. F. Renard : "*Challenger*" *Rep.* (Deep Sea Deposits), 1891, p. 240.

Volcanite, *Hobbs*, 1893. — A volcanic rock composed essentially of anorthoclase and augite, and having the chemical composition of dellenite.

(Volcano, Lipari Is.)

W. H. Hobbs : *Bull. Geol. Soc. Am.*, v, 1893, p. 598.
A. Lacroix : *C.R.*, cxlvii, 1908, p. 1491.

Volhynite, *Ossovski*, 1885.—A variety of quartz-kersantite containing phenocrysts of plagioclase and hornblende, with or without biotite, in a groundmass of quartz and felspar with abundant chlorite. (Volhynia, Russia.)

Vug or **Vugh.**—A mining term for an unfilled cavity in a vein, generally with a mineral lining of different composition from that of the immediately surrounding ore.

Vulsinite, *Washington*, 1896. — A variety of trachyandesite, similar to banakite, but somewhat richer in potash.

(Bolsena, Vulsinian district, Italy.)

H. S. Washington : *Journ. Geol.*, iv, 1896, p. 55.

W

Wacke.—An old term for a dark green to brownish black earth or clay formed as the final residual decomposition product of basaltic rocks and tuffs.

Weathering.—The destructive alteration and decay of rocks by exogenetic processes acting at the surface and down to the depth to which atmospheric oxygen can penetrate.

G. P. Merrill : *Rocks, Rock Weathering and Soils*, 1906.
E. Steidtmann : *Econ. Geol.*, iii, 1908, p. 381.
J. W. Evans : *Proc. Geol. Assoc.*, xxiv, 1913, p. 245; xxv, 1914, p. 229.
E. Weinschenk (Trans. by A. Johannsen) : *Fundamental Principles of Petrology*, 1916, p. 73.

Websterite, *Williams,* 1890.—A variety of pyroxenite composed of both monoclinic and orthorhombic pyroxenes.

Wehrlite, *Kobell,* 1839.—A variety of peridotite containing diallage. The name is now extended to include with diallage all other varieties of monoclinic pyroxenes.

M. E. Schuster : *Geognost. Jahresheft,* xviii, 1907, p. 43.

Weiselbergite. — A variety of micro-porphyritic dolerite having a microlitic texture resembling that of augite-andesite. Crystals of labradorite, augite, and iron-ores are embedded in a groundmass composed of plagioclase and augite microlites with interstitial glass.

(Weiselberg, Nahe District.)

Welded Dykes, *Weinschenk.*—A term applied to pegmatitic and aplitic dykes, the boundaries of which have been obliterated by continued growth of the minerals of the granite into which the dykes have been injected.

Wennebergite, *Schuster,* 1905.—A variety of quartziferous porphyry characterised by phenocrysts of orthoclase, biotite, and quartz, in a microcrystalline and chloritic groundmass containing abundant apatite and sphene. (Wenneberg, Ries.)

Whinstone.—A popular general name for dark coloured rocks such as dolerite, basalt, porphyrite, andesite, etc., which are comparatively unaltered, intrusive or interbedded, have a crystalline texture not usually coarse, and are composed of the minerals felspar, pyroxene, and iron-ores, with or without hornblende or olivine. As a trade-name, it is recommended by the British Engineering Standards Association that the term *whinstone* should be strictly confined to rocks which come under the trade heading of basalt. According to the same authority the latter includes basalt, diabase, dolerite, epidiorite, greenstone, lampro-

phyre, spilite, and teschenite. According to this usage *whinstone* is made to cover both whinstones and greenstones, and includes types which collectively have usually been known as *trap-rocks*. Cf. *Trap*.

A. Holmes: *Geological and Physical Characters of Concrete Aggregates*, B.F.P.C. "Red Book," 256, 1920, p. 40.

Wichtisite.—A modification of dolerite rich in glass occurring as selvages in sills or dykes or as small independent intrusions.

(Wichtis, near Helsingfors, Finland.)

Wilsonite.—A rhyo-andesite tuff containing fragments of pumice and andesite in a matrix consisting of shreds of glass in a granular isotropic base. The rock has also been interpreted as a brecciated rhyolite flow, but the evidence appears to be against this view. (Owharoa, Hauraki, N.Z.)

Geol. Surv. N. Zealand, Bull. 16, 1913, p. 70.

Windsorite, *Daly*, 1903. — A leucocratic variety of quartz-monzonite, containing a small percentage of biotite. (Windsor, Vermont.

R. A. Daly: *U.S.G.S. Bull.*, 209, 1903, p. 45.

Woodendite, *Skeats & Summers*, 1912.—A variety of orthoclase-bearing basalt resembling absarokite. (Woodend, Victoria.)

E. W. Skeats & S. Summers: *Geol. Surv. Victoria, Bull.* 24, 1912, p. 31.

Wurtzilite.—A massive, black, elastic bituminous substance, having a brilliant lustre and a conchoidal fracture. It differs from members of the asphaltite group not only in its elasticity, but also in resisting the usual solvents.

Wyomingite, *Cross*, 1897. — A porphyritic dyke-rock with phenocrysts of phlogopite in an aphanitic groundmass containing leucite and diopside; = *phlogopite-leucite*. (Wyoming.)

W. Cross: *Am. Journ. Sci.*, iv, 1897, p. 120.

X

Xenoblast, *Becke,* 1903.—A term applied to crystals which have grown during metamorphism without the development of their characteristic faces. Cf. *Idioblast.*

Xenocryst, *Sollas,* 1894. — A term applied to allothigenous crystals, generally corroded, that are foreign to the igneous rock in which they occur.

Xenolith, *Sollas,* 1894. — A term applied to allothigenous rock fragments that are foreign to the igneous rock in which they occur; = *accidental inclusion,* = *exogenous enclosure,* = *enclave enallogène.*

A. Harker: *Mem. Geol. Surv.* (Tert. Ig. Rocks Skye), 1904, p. 351.

Y

Yamaskite, *Young,* 1906.—A medium or fine-grained rock composed of basaltic hornblende and titan-augite, with a small amount of anorthite, and accessory iron-ores and biotite; olivine-bearing varieties are also known.

(Mt. Yamaska, Quebec.)

J. J. O'Neill: *Geol. Surv. Canada, Mem.,* 43 (Pub. No. 1311), 1914, p. 64.

Yatalite, *Benson,* 1908.—A pegmatoid rock (associated with a titaniferous series of diopside-syenites and diorites) containing as its chief constituent uralitic actinolite (after diopside) with poikilitic inclusions of magnetite and sphene. The other minerals present are albite with microcline titaniferous magnetite, apatite and sphene.

W. N. Benson: *Trans. and Proc. Roy. Soc. S. Australia,* xxxiii, 1909, p. 126.

Yentnite, *Spurr,* 1900. — A coarse-grained granitoid rock essentially containing primary scapolite,

plagioclase (oligoclase-andesine), and biotite; = *scapolite-belugite*. (Yentna R., Alaska.)

J. E. Spurr : *Am. Journ. Sci.*, x, 1900, pp. 310-15.

Yogoite, *Weed & Pirsson,* 1895. — A melanocratic facies of syenite containing augite and orthoclase, with smaller amounts of biotite and oligoclase-andesine. (Yogo Peak, Montana.)

W. H. Weed & L. V. Pirsson : *Am. Journ. Sci.*, l, 1895, p. 472; li, 1896, p. 351.

Z

Zeolitisation, *Lacroix*, 1896. — The process whereby the felspars and other alumino-silicates of a rock are transformed into zeolites.

A. Lacroix : *Min. de la France*, ii, 1896, p. 45.

Zobtenite, *Roth*, 1887.—A variety of gabbro-gneiss containing knots or eyes of diallage surrounded by streams of uralite and embedded in a granular mass of epidote and plagioclase (saussurite). (Zobtenburg, Silesia.)

Zoning. — A term applied to the structure of a mixcrystal which is composed of isomorphous compounds arranged in layers or zones of different composition; successive zones having been deposited from a magma (or other liquid solution), which gradually changed in composition owing to the separation of crystal phases.

N. L. Bowen : *Am. Journ. Sci.*, xl, 1915, p. 180, and *Journ. Geol. Supp.*, vol. xxiii, 1915, p. 38.

APPENDIX A

FRENCH PETROGRAPHIC TERMS

A

Adélogène, aphanitic.
Affleurement, outcrop; exposure.
Agents minéralisateurs, mineralising agents.
Agrégées (*Roches*), clastic (rocks).
Aiguille, needle (acicular mineral); spine (e.g. of Mount Pelée).
Alluvion, alluvium.
Alluvion aurifère, placer.
Amas, stockwork.
Amiante, asbestos.
Amphigène, leucite.
Amphigénite (Cordier, 1868), leucite-tephrite and other basaltic rocks containing leucite.
Anagénite, conglomerate formed of fragments of granite, gneiss or schist.
Ancienne (*éruptive*), term applied to pre-Tertiary igneous rocks.
Anorthose, plagioclase (Delesse); now used for anorthoclase.
Arendalite, garnet rock.
Ardoise, slate.
Argile, clay.
Argile smectique, Fuller's earth.
Argileuse, argillaceous.

B

Bâtonnée (*structure*), mortar texture.
Boue, mud; ooze.
Boules (*division en*), spheroidal partings in igneous rocks.
Bulle, gas bubble, in inclusions of minerals.
Bulleuse, vesicular.

C

Cailloutis, gravel.
Calcaire, limestone.
Cargneule, cellular dolomite.
Cassure, fracture.
Chaille, siliceous concretion.
Chalumeau, blowpipe.
Charriage, overfold.
Cheires, flows of block-lava; = *aa*.
Chevauchement, overfold, thrust.
Cicatrisation, healing of broken or corroded crystals by a secondary deposit of the same material in optical continuity.
Colonnes filtrantes, streams of hot gases rising from the earth's interior.
Composé, heterogeneous, composite.
Corindon, corundum.
Cornéenne, hornfels.
Cornes, hornfels, adinole and allied products of contact metamorphism.
Corrosion, quartz de, see *quartz vermiculé*.
Couche, bed or stratum.
Coulée, lava stream or flow.
Couronne, corona.
Craie, chalk.
Culot, plug (volcanic).

D

Délit, joint.
Diaclase, joint.
Dipyrisation, scapolitisation.
Disthène, kyanite.
Domaine, province (petrographical).
Dureté, hardness.

E

Éclat, lustre.
Ecoulement (*structure d'*), flow or fluxion structure.
Éluviale, residual (deposits).
Enclaves énallogènes (Lacroix), xenoliths or accidental inclusions. (See page 90.)
Enclaves homœogènes (Lacroix), autoliths or cognate inclusions.
Épanchement (*Roches d'*), effusive or volcanic rocks.
Epontes, walls of the country rock enclosing a dyke or vein.
Exomorphisme, contact metamorphism of the rocks invaded by a magma.
En coin, cunéiforme, wedge-shaped.
Entrecroisée (*stratification*), cross- or current-bedded.
Endomorphisme, modifications produced in a magma (and hence in the resulting rock) by interaction with the rocks invaded.
Entroques (*calcaire à*), crinoidal limestone.
Epontes, walls of veins or dykes.

F

Faille, fault.
Faluns, shelly beds (Tertiary); crag.
Farine fossile, diatom earth.
Fenestrée (*structure*), lattice structure (e.g. of serpentine after hornblende).
Feuilletée, foliated.
Filon, vein, dyke.
Filon couche, sill.
Fluorine, fluor spar.
Forage, boring.

G

Galet, pebble, shingle.
Gemme, gem; *Sel gemme* = rock salt.
Gisement, deposit; formation.
Gite metallifère, metalliferous vein.
Glanduleuse (*structure*), augen or phacoidal structure.
Globulaire, spherulitic.
Grand, coarse sand; fine gravel.
Granitelle, a leucocratic quartz-felspar granite.
Granitite, a two mica granite, or according to some authors a plagioclase granite (*adamellite*).
Granulite, muscovite-granite (*cf.* English usage of term).
Gravier, gravel.
Grenat, garnet.
Grenue (*structure*), granular, granitic, saccharoidal; a term applied to holocrystalline rocks in which there is no apparent discontinuity in crystallisation.
Grès, sandstone.
Gries, detritus; intermediate in grade between *graviers* and *galets*.

H

Hemithrène, epidiorite rich in calcite.
Hémitrope, twinned.
Héteromorphique, heteromorphic. (See page 117.)
Houille, coal.
Houille grasse, bituminous coal.
Houille maigre, steam coal.
Houille sèche, cannel coal.
Hyalomicte, greisen.

I

Inclinaison, dip.

Inclusions, term restricted to inclusions (gas, liquid, glass or mineral) in minerals; not, as in English, also denoting xenoliths, etc. (*cf. enclaves*).

K

Kersanton, kersantite.

L

Labrador, labradorite.
Labradorite, olivine-free basalt.
Ladères, sarsens (blocks of Eocene sandstone which have resisted denudation up to the present day).
Leptoclase, a minute fissure.
Lentille, lens.
Libelles, gas inclusions in minerals.
Limon, loam.
Lit, thin layer, lamina.
Lithoclase, rock fracture (of any kind).

M

Mâcle, twin.
Maclifère, see **Schiste maclifère.**
Macline, spotted slate, chiastolite slate, etc.
Maillée (*structure*), mesh structure.
Marne, marl.
Menilite, nodules of opal.
Microgrenue (*structure*). The texture of a holocrystalline rock with apparent discontinuity in crystallisation (indicated by the presence of phenocrysts), the groundmass being *grenue.*
Microlitique (*structure*). The texture of a porphyritic rock, the groundmass of which is composed largely of more or less idiomorphic tabular or prismatic crystals (*e.g.*, felspar laths) with or without interstitial glass.
Minerai, ore.
Minette, local name for the iron-ores of Lorraine.
Miroirs de faille, slickensides.
Mortier (*structure en*), mortar structure.
Moule, matrix.

N

Nappe, sheet or flow (*e.g.*, lava flow or sill).
Nuée ardente, luminous cloud of ash and gases (formed during intense volcanic explosions of the Péléan-type).

O

Œillé (*gneiss*), augen gneiss.
Oligiste, hæmatite.
Ollaire (*pierre*), steatite; talc schist.
Ophiolite, a term for serpentine.
Orthose, orthoclase.

P

Paléovolcanique, term applied to pre-Tertiary volcanic rocks.
Paraclase, fault.
Pate, magma.
Pâte vitreuse, glassy base.
Pendage or **inclinaison,** dip.
Petrosiliceuse, felsitic.
Phanérogène, coarsely granular or phanerocrystalline.
Pli, fold.
Plissement, fold.
Phyllade, phyllite.
Poids spécifique, specific gravity.
Ponce, pumice.
Poudingue, puddingstone.
Promorphisme, devitrification.

Q

Quartz de Corrosion =
Quartz vermiculé, drop-like inclusions of quartz in felspar; intergrowths of quartz with plagioclase, as in *myrmekite.*

R

Recif corallien, coral reef
Réticulée (*structure*), netted structure (*e.g.*, of serpentine).
Rétinite, pitchstone.
Ride, ripple.
Roches d'imbibition, rocks injected by granitic magma *e.g.*, injection gneiss.
Rubané, banded.

S

Sable, sand.
Salse, mud volcano.
Schiste, slate.
Schiste argileux, shale.
Schiste cristalin, schist.
Schiste maclifère, chiastolite "slate."
Sel gemme, rock salt.
Silex, flint.
Stade, stage or period (*e.g.*, of crystallisation).
Synclase, contraction joints.

T

Tacheté (*schiste*), spotted slate or schist.
Terrains, formations, series of sediments.
Tourbe, peat.
Treillisée (*structure*), lattice structure (*e.g.*, of serpentine, after hornblende).
Typhon, boss; stock; batholith.

V

Vacuole, vesicle.
Vermiculé (*quartz*), drop-like inclusions of quartz in felspars.
Vitreux, glassy.

APPENDIX B

GERMAN PETROGRAPHIC TERMS

Compiled by Miss J. H. Robertson

A

Abblätterung, exfoliation.
Abgespalten, differentiated.
Ablagerung, deposit.
Abkühlungsdifferentiation, liquation in a magma before crystallisation.
Abraum, detritus.
Abraumsalze, sulphates and chlorides of potassium and magnesium (as in the Stassfurt deposits).
Absonderung, joint; parting (between two beds of rock); cleavage or striation (*e.g.*, of diallage); separation or segregation from a magma.
Abteilung, formation or series (stratigraphical).
Abyssische Spaltung, abyssal differentiation.
Abzweigungen, apophyses.
Achatmandel, agate amygdules.
Achsen, see **Axen.**
Adergneis, injected or veingneiss.
Adern, veins.
Adiagnostisch, indistinguishable.
Afterkrystall, pseudomorph.
Aggregatzustand, solid state.
Akzessorisch, accessory.
Alteruptivgesteine, a general designation for pre-tertiary igneous rocks.
Angeschmolzen, fused, welded.
Asche, ash.
Atmosphärilien, atmospheric agents of weathering.
Aufgenommene Gemengteile, assimilated constituents.
Auflösung, solution.
Auflösungsgrenze, limit of (microscopic) resolution.
Ausbleichung, bleaching.
Ausbruch, eruption.
Ausfällung, precipitation.
Ausfüllungsräume, infillings of a cavity.
Aushauchung, exhalation.
Auskeilen, to thin out.
Auslaugung, lixiviation, leaching.
Auslaugungshöhle, cavities or hollows due to solution or leaching.
Auslöschung, extinction (between crossed nicols).
Auslöschungsschiefe, extinction-angle.
Ausscheiden, to separate out.
Austausch, exchange (*e.g.*, of material in alteration processes).
Ausweichungsclivage, strain-slip cleavage.
Auswürflinge, *lapilli, ejectamenta.*
Axenbild, interference-figure or directions-image.

B

Bänderung, a streak, stripe or band.

Begleitende Bestandmassen, associated constituents such as concretions and secretions.
Begleitmineralien, associated minerals.
Belastungsmetamorphismus, load metamorphism.
Beschaffenheit, constitution.
Bestandteile, constituents.
Beton, concrete.
Beweglichkeit, mobility.
Bildlos, amorphous, structureless.
Bildung, formation (of a rock).
Bildungsweise, mode of formation.
Bindemittel, cement.
Biolithe, sediments of organic origin.
Bläschen, gas bubble (in inclusions).
Blasenräume, vesicles.
Blätterstein, pillow-lava, variolite, or spilite.
Blitzröhren, fulgurite.
Blauschlamm, blue mud.
Blocklehm, boulder-clay.
Block-strand, boulder-beach.
Blutsverwandtschaft, consanguinity.
Bodenanalyse, soil analysis.
Bogenstruktur, see p. 48.
Bohnerz, pisolitic limonite.
Borsäure, boric acid.
Brauneisenstein, limonite.
Brechungsverhältnis, refractive index.
Bruch, fracture.
Bruchig, clastic, fragmental.
Bruchstücke, fragments.

C

Chemische Verwandtschaftskräfte, chemical affinity.

D

Dachschiefer, roofing slates.
Dachziegelartig, imbricated, overlapping.
Dampfsporen, gas inclusions.
Darg, peat formed from marine vegetation.
Decke, sheet or cover (*e.g.*, lava-sheet.
Diabasisch-körnige, ophitic.
Dichte, density.
Dichtebestimmung, determination of density.
Dick-schieferig, thick-bedded.
Differenzierung, differentiation.
Dislocationsmetamorphismus, dynamic metamorphism.
Doppelbrechung, double refraction.
Doppelgang, composite dyke.
Dreiwertig, trivalent.
Druck, pressure, compression.
Dünn-schiefenig, thin-bedded.
Dünnschliff, thin section.
Durchgreifende, intrusive.
Durchsichtig, transparent.
Durchtränkung, saturation.
Durchwachsung, intergrowth, interpenetration, as in graphic granite.

E

Ebenschieferig, even-bedded.
Edelsteinsande, gem sands.
Eigenschaft, property.
Einfall, dip.
Eingesprengt, disseminated.
Einschlüsse, inclusions, in either minerals or rocks.
Einschmelzung, assimilation.
Einsprenglinge, phenocrysts.
Einwertig, univalent.
Eisener Hut, gossan.
Eisenoxyd, ferric oxide.
Eisenoxydül, ferrous oxide.
Endogene Einschlüsse, cognate inclusions, autoliths, enclaves homœogènes.
Entgasung, exudation of gas.
Entglasung, devitrification.
Erdharz, Erdpech, bitumen, asphalt.

Erguss, effusion.
Erkennungsmittel, determinative test.
Erlanfels, basic granulite.
Ersetzung, replacement, metasomatism.
Erstarrend, solidifying, crystallising.
Erstarrungsgesteine, igneous rocks.
Eruptivdecke, lava-sheet.
Erz, ore.
Erzader, mineral lode or vein.
Exogene Einschlüsse, accidental inclusions, xenoliths, enclaves énallogènes.
Explosionsröhre, volcanic pipes.

F

Fahlbänder, banded or foliated rocks impregnated with sulphide-ores.
Fallen der Schichten, dip of strata.
Falsche Schieferung, false cleavage or bedding.
Faltung, folding.
Feuerflüssig, molten.
Feuerton, fireclay.
Filzartig, filzig, felted (applied to felt-like aggregates of minute elongated crystals).
Flaserig, "flaser"; lenticular structure of dynamically metamorphosed rocks.
Fleckschiefer, spotted slate.
Flötz, seam, *e.g.*, coal-seam.
Flugsand, blown sand.
Fluss Kieselsäure, fluo-silicic acid.
Fluss-säure, hydrofluoric acid.
Forellenstein, troctolite.
Frittung, fritting, partial fusion of country rock by volatile fluxes.
Fruchtschiefer, knotted slate, in which the spots vaguely resemble ears of corn.

G

Gang, dyke, vein, or lode.
Gangausläufer, apophyses.
Ganggefolge, suite of related dykes.
Ganggefolgschaft, differentiated series of dykes.
Ganggesteine, dike rocks.
Gangulmen, walls enclosing a dyke or lode.
Gangwände, selvage of a dyke or lode.
Gärbenschiefer, spotted slate or schist, in which spots have a sheaf-like form.
Gebirgsbildende Prozesse, orogenic processes.
Gebirgsdruck, orogenic pressure.
Gediegen, native (as applied to minerals).
Gefaltet, folded.
Gefrierpunkt, freezing-point.
Gehängeschutt, talus.
Gekammerte Spheruliten, hollow spherulites, or lithophysæ.
Gelenkquarz, flexible sandstone.
Gemengteil, constituent.
Gemischte Gänge, composite dykes.
Gepresster Granit, foliated granite.
Gerölle, pebbles or boulders.
Gerichteter Druck, directed pressure.
Geschiebe, angular debris, scree deposits.
Gestein, rock.
Gesteingase, magmatic gases.
Gesteinsbruchstücke, rock-fragments.
Gesteinslehre, petrology.
Gesteinsserie, Brögger, 1894.—A series of related igneous rocks possessing certain chemical, mineral and textural features in common, and exhibiting together a continuous variation from one extremity of the series to the other.

Gestreckte, linear (applied to the texture of foliated rocks).
Gestreift, striated.
Gestrickte Formen, skeleton crystals.
Gestrickte Struktur, netted structure (in serpentine formed from augite).
Gitterstruktur, lattice structure (in serpentine, derived from hornblende); cross hatching (in microcline).
Glanz, lustre.
Glasglänzend, of vitreous lustre.
Gleichgestaltet, isomorphous.
Gleichmässig körnig, even grained.
Gleichmässige Gesteine, rocks of uniform grain.
Gleitflächen, gliding planes.
Glimmer, mica.
Granat, garnet.
Grand, gravel.
Granoblastische or **Pflaster Struktur**, mosaic texture.
Griffelschiefer, pencil slate.
Grundteig, matrix.
Grüne Schiefer, chlorite schists and allied metamorphic rocks.
Grus, granitic sub-soil.

H

Hälleflinta, a banded granulite, having the composition of a quartz-porphyry.
Härte, hardness.
Hauptbruch, master joint.
Hauptgemengteile, essential or major constituents.
Helizitische Struktur, helicitic texture.
Herausgelöst, dissolved or leached out.
Hitzewirkung, action of heat.
Homöoblastische Struktur, equigranular texture.
Hornstein, chert and allied siliceous rocks.

I

Intrusivlage, intrusive sheet or sill.
Injizierter Schiefer, injected schists or gneisses.

K

Kali, potash.
Kalkabsätze, deposits of $CaCO_3$, calcium carbonate.
Kalkspat, calcite.
Kalktuff, travertine.
Kalziphyr, calciphyre.
Karstenite, anhydrite rock.
Kaolinbildung, or **Kaolinisierung**, kaolinisation.
Keilartig or **Keilförmig**, wedge-shaped.
Kelyphitrinde, kelyphytic border.
Kies, coarse sand, fine gravel.
Kelsader, quartz-vein.
Kieselconglomerate, puddingstone.
Kieselerde, siliceous earth.
Kieselguhr, diatomaceous earth.
Kieselsäuregallerte, gelatinous silica.
Kieselsäure, silicic acid.
Kieselstein, pebble, stone, flint.
Kieslagerstätten, pyritic deposits.
Kleinkrystallin, microcrystalline.
Klingstein or **Klinkstein**, phonolite.
Klemenfüsser, brachiopod.
Klüfte, joints.
Kluftflächen, fracture-planes.
Knochenbreccie, bone-breccia.
Knollen, nodules.
Knotenschiefer, spotted shale or slate (in the outer part of a metamorphic aureole).
Kohlenstoff, carbon.
Kohlenstoffhaltig, carbonaceous.
Kohlensäure, carbonic acid.
Kohlige Substanz, carbonaceous matter.
Kontraktions-spalte, shrinkage fissures.

Körnig, granular.
Kreuzschichtung, cross-bedding.
Krummschieferig, sinuous or wave-like lamination.
Krystallgestalt, crystal form.
Krystallkern, nucleus of crystallisation.
Krystallskelette, skeleton crystals.
Kügelchen, spherulites.
Kugelgranit, orbicular granite.
Kugelige Absonderung, spheroidal partings of igneous rocks.
Kugelige Verwitterung, spheroidal weathering.
Kuppe, puys, domes.

L

Lage, bed or sheet.
Lagenstruktur, lamination.
Lagenförmig, banded.
Lagergang, sill.
Längenschnitt, longitudinal section.
Lehm, mud.
Lehmig, argillaceous.
Lepidoblastische or **Schuppige Struktur,** flaky structure.
Linsenförmig, lens-shaped.
Löcherig, pitted, porous, perforated.
Lockere Ablagerungen, loose deposits.
Lösung, solution.
Lötrohr, blow-pipe.

M

Magmatische Spaltungsprozesse, magmatic differentiation.
Magnetkies, pyrrhotite.
Mandelförmig, amygdaloidal.
Mandelsteine, amygdaloids.
Marmorisirung, metamorphosis of limestone to marble.
Maschenstruktur, mesh structure (in serpentine derived from olivine).
Massenausbrüche, fissure eruptions.
Meeresabsätze, marine deposits.
Mehlsand, silt.
Mergel, marl.
Mikroscopieren, to examine microscopically.
Mineralbildner, mineralisers.
Mineraltrennung, separation of minerals.
Mischbarkeit, miscibility.
Mischgesteine, migmatites, hybrid rocks.
Mischkristalle, mixed crystals (*i.e.*, with isomorphous substances in solid solution).
Monomineralisch, consisting of but one mineral.
Mörtelstruktur, mortar texture.
Mulde, syncline.
Murbrukstruktur, mortar texture.
Muschelig, conchoidal.
Mutterlauge, mother-liquor.

N

Nachschübe der Spaltungsgesteine, subsequent intrusions of differentiated rocks (complementary dykes).
Nädelchen, needle (acicular mineral).
Natron, soda.
Nebengemengteile, accessory or minor minerals.
Nebengestein, country-rock.
Nematoblastische or **faserige Struktur,** fibrous texture.
Neugebildet, secondary, authigenous.

O

Oberflächengesteine, volcanic, extrusive, or effusive rocks.
Objektträger, microscope-slide.
Oelschiefer, oilshale.
Orientierter Druck, directed pressure, stress.

P

Pechstein, pitchstone.
Pflasterstruktur, mosaic texture.
Piëtrokristallisation, crystallisation during powerful lateral pressure (applied to the formation of the central granite of the Alps).
Plättchen, lamina.
Plattige Verwitterung, platy weathering seen on the *exposed surface* of certain igneous rocks.
Plattig-schieferig, laminated.
Pleochroitische Höfe, pleochroic haloes.
Poikiloblastische or **helizitische Struktur,** helicitic texture.
Porphyroblastische Struktur, pseudo-porphyritic texture (in metamorphic rocks, due to the presence of relatively large crystals which have developed in the rock by recrystallisation).
Putzen, xenoliths or cognate inclusions.

Q

Quadern, flags; term applied to flaggy rocks and to those which can be quarried in blocks of cubic or rectangular prismatic form; freestone.
Quaderstein, freestone.
Quartz-Keil, quartz wedge.
Quellkuppe, lava dome.
Querbruch, transverse fracture.
Querschlägig, transverse.
Quetschfläche, crush plane.

R

Rand, edge, periphery.
Randfacies, marginal facies (*e.g., of an intrusion*).
Rauchkalk, magnesian limestone.
Reibungsbreccie, friction-breccias.
Reibungsflächen, slickensides.
Reihenfolge, sequence.
Reihenfolge der Kristallisation, order of crystallisation.
Reihenfolge der Schmelzbarkeit, order of fusibility.
Reisenkörnig, very coarse grained.
Richtung, direction.
Roggenstein, oolite, roestone.
Rückstand, residue.
Rutschflächen, slickensides; gliding planes in minerals.

S

Sahlband, selvage of a vein or dyke.
Salzsäure, hydrochloric acid.
Sanduhrstruktur, hour-glass structure.
Sättel, anticlines.
Sättigungspunkt, saturation point.
Sauerstoff, oxygen.
Säulige Absonderung, columnar structure.
Saurstoff, oxygen.
Schalige Abblätterung, spheroidal exfoliation.
Schalige Verwitterung, spheroidal weathering.
Schalstein, sheared tuff, generally basic or calcareous.
Schicht, bed or layer.
Schichtfläche, bedding or schistosity planes.
Schichtgestein, stratified rock.
Schichtung, bedding or stratification.
Schieferung, cleavage (of rocks).
Schieferig, slaty, foliated, lamellar, schistose.
Schieferton, shale.
Schiefwinklig, oblique.
Schiller, the shining lustre of minerals such as hypersthene.

Schillerfels, serpentine containing bastite.
Schillerspath, bastite.
Schizolithe, diaschistic or differentiated dyke rocks.
Schlackenlava, scoriaceous lava.
Schlamm, mud, silt, ooze.
Schlämmen, to elutriate.
Schliege, concentrate.
Schlieren, streaks in igneous rocks differing in texture and composition from the normal mass of the rock, but without sharply marked boundaries.
Schmelzflüssig, molten.
Schmelzfluss, melt, or fused mass.
Schmelzwärme, latent heat of fusion.
Schmelzpunkt, melting point.
Schmelzlösung, molten solution.
Schmelzung, melting.
Schollenlava, block lava.
Schotter, shingle.
Schüppchen, scale of film.
Schwefelkies, pyrite.
Schwefelsäure, sulphuric acid.
Schwefelwasserstoff, sulphuretted hydrogen.
Schwerkraft, gravitation.
Seifen, gem sands; placers.
Seigerung, liquation.
Seitendruck, lateral pressure.
Schotter, shingle.
Siebstruktur, sieve texture.
Siedequelle, geyser.
Sippe, tribe, series, *e.g.* "Atlantic" and "Pacific" series.
Smirgel, or **Schmergel,** emery.
Sonderung, sorting out.
Spaltbarkeit, cleavage (of minerals).
Spaltungsgesteine, differentiation rocks.
Spaltungsvorgänge, differentiation processes.
Spezifisches Gewicht, specific gravity.
Spratzige Lava, Aa-lava.
Spreustein, zeolite.
Sprödigkeit, brittleness.
Sprung, fissure.
Stachelhäuter, echinoderms.
Steinkohle, coal.
Steinkohlenflötz, coal-seam.
Steinwulst, nodule.
Stellvertretendo Gementeile, "substitute" constituents (*e.g.*, sodalite in place of nepheline).
Stickstoff, nitrogen.
Strahlstein, actinolite.
Streckung, parallel or fluxion structure (extension of minerals along roughly parallel lines due to flow or recrystallisation).
Streichen der Schichten, strike of strata.
Strengflüssig, refractory.
Strom, lava stream or flow

T

Tafelig, tabular.
Tegel, brick-earth.
Teig, paste, magma.
Teilmagma, partial or fractional magma.

Ton, clay (often used in combination with another noun, or preceded by a specific adjective which gives the composition, *e.g.*, *Tonschiefer*=clay-slate; *Kaolinisher Ton*=*Kaolin*).
Tonerde, alumina.
Tonig, argillaceous.
Transversale Schieferung, transverse cleavage.
Tropfstein, stalactite.
Trümer, vein or dyke.
Trümmer, debris.
Trümmergesteine, clastic rocks.
Tutenmergel, cone-in-cone structure.

U

Übergangsglieder, transition-types or members.
Übergemengteile, secondary minerals.
Übersättigt, oversaturated.
Überschiebung, overfold.
Umbildung, alteration, reconstruction.
Umlagerung, rearrangement; paramorphism; migration.
Umkristallisation, recrystallisation.
Umwandlung, alteration.
Ungeschlehtet, unstratified, massive.
Unlöslich, insoluble.
Unmischbar, immiscible.
Urgebirge, fundamental crystalline formations.
Urschiefer, primeval schist.
Ursprünglich, original, primary.

V

Verbandsfestigkeit, cohesion.
Verbindung, combination.
Verdrängung, replacement.
Verfestigung, consolidation.
Vergrösserung, magnification.
Verhärtung, induration.
Verkieselter Hornfels, silicified hornstone.
Verkieselung, silicification.
Verkittung, cementation.
Verruschelungszone, crushed zone.
Verschiebung, displacement.
Verschweiste Gänge, welded dykes.
Versuch, experiment.
Vertikale Belastung, vertical pressure.
Verwachsung, intergrowth.
Verwerfung, fault.
Verwitterung, weathering.
Verwitterungslösung, solutions produced during action of weathering.
Verwitterungsprodukte, products of weathering.
Verzahnte Struktur, sutured structure.
Verzwillingt, twinned.
Vollkrystallinisch, holocrystalline.
Vorgänge, processes.
Vorherrschend, predominant.

W

Wacke, weathering residue of subsilicic igneous rocks.
Wanderblock, erratic.
Warmbrunnen, thermal springs.

Wasserstoff, hydrogen.
Wechsellagern, interbedded.
Weichtiere, mollusca.
Wellenfurchen, ripple-marks.
Wesentliche Gemengteile, essential constituents.
Wirkung (z.b. der Mineralbildner), action (*e.g.* of mineralisers).
Wüstensand, desert sand.

Z

Zeichenschiefer, pencil-slate.
Zerfressen, corroded.
Zerklüftung, fissure, joint.
Zersetzung, replacement of a mineral by decomposition products other than those due to weathering.
Zertrümmerung, disintegration.
Zonarer Aufbau, zonal structure (in crystals).
Zuckerkörnig, saccharoidal.
Zufuhrkanäle, feeding channels.
Zugeführte Gemengteile, secondary minerals (whose formation involves the addition of material from external sources, *e.g.*, tourmaline).
Zusammensetzung, composition (mineral or chemical).
Zweiwertig, bivalent.
Zwischenformen, passage-types.
Zwischenklemmungsmasse, mesostasis (interstitial matter).
Zwischenmasse, cement.
Zwischenräume, interstices.

ABBREVIATIONS COMMONLY USED.

a.a.O.,	(an anderen Orten), (am angeführten Orte),	elsewhere, or *loc. cit.*
A.G.,	(Atomgewicht),	atomic weight.
Bd.,	(Band),	volume.
bez.,	(bezüglich),	in reference to, etc.
bezw., bzw.,	(beziehungsweise),	respectively.
ca.,	(circa),	about.
dgl.,	(dergleichen),	such like.
d.h.,	(das heisst),	that is to say.
d.i.,	(das ist),	that is, *i.e.*
Hs.,	(Handschrift),	manuscript, MS.
s.o.,	(siehe oben),	see above.
sog.,	(sogenannt),	so-called.
s.u.,	(siehe unten),	see below.
u.a.,	(unter anderen),	among others.
u.ä.m.,	(und ähnliches mehr),	and the like.
u.a.m.,	(und andere mehr),	and others, and so on
u.ö.,	(und öfter),	*passim.*
u.s.f.,	(und so fort),	and so forth.
usw.,	(und so weiter),	and so on, *etc*
za.,	(zirka),	about.
z.B.,	(zum Beispiel),	for example, *e.g.*

APPENDIX C

GREEK WORDS AND PREFIXES

A, an	not, without	*amorphous, aphanitic, anhedral, asphalt.*
Abyssos	bottomless	*abyssal, hypabyssal.*
Achates	a river in Sicily	*agate.*
Adinos	close, dense	*adinole.*
Æolus	God of the winds	*æolian.*
Aer	air	*aerolite.*
Akme	a point	*acmite.*
Aktis	a ray, spoke	*actinolite, stalactite.*
Allo, allothi	elsewhere, otherwise	*allotropy, allogenic, allothigenous.*
Allotrios	alien, foreign	*allotriomorphic.*
Amphi	about, around	*amphigene.*
Amphibolos	doubtful	*amphibole.*
Amygdale	an almond	*amygdale.*
Ana	towards, up to	*anamesite, anamorphism, anatexis.*
Analkis	weak	*analcite.*
Anchi	near at hand	*anchi-eutectic.*
Anthrax	carbon	*anthracite, anthraxolite.*
Anti	opposite	*anticline.*
Apatao	to deceive	*apatite.*
Aphros	foam	*aphrolith.*
Apo	(derived) from	*apo-rhyolite, apophyllite.*
Apophyas	an offshoot	*apophyses.*
Arche	first cause, origin	*Archæan.*
Auge	sheen	*augite.*
Aura	exhalation	*aureole.*
Auto, auth	self	*autoclastic, autolith, automorphic, authigenous.*
Axine	a wedge	*axinite.*
Axon	an axle	*axiolite.*
Barus	heavy	*barytes.*
Basanos	a test, means of trial (touchstone)	*basanite.*
Bathos	depth	*batholith.*
Belone	an arrowhead	*belonite.*
Blastos	a bud, sprout	*crystalloblastic.*

Botrus	a bunch of grapes	*botryoidal.*
Byssos	depth	*bysmalith.*
Chadein	to hold	*chadacryst.*
Chalchos	copper	*chalcopyrite.*
Chi, χ	a Greek letter (ch)	*chiastolite.*
Chloros	green	*chlorite.*
Chthon	earth	*autochthonous, allochthonous.*
Cryos	icy	*cryolite.*
Chrysos	gold	*chrysotile, chrysolite.*
Dactylos	a finger	*dactylitic, dactylotype.*
Dendron	a tree	*dendritic.*
Derma	skin	*dermolith.*
Deuteros	second	*deuteric.*
Dia	through	*diablastic, diagenesis, diaschistic, diatreme, diopside.*
Diabasis	a crossing over	*diabase.*
Diallage	an interchange	*diallage.*
Diorizo	to delimit	*diorite.*
Dis, di	twice, double	*disthene, dimorphism.*
Doleros	deceptive	*dolerite.*
Drus	an old tree (*e.g.*, with fungus-lined pockets)	*drusy.*
Ec, ex, exo	out from	*exogenetic, exomorphism.*
Eidos	form	*amygdaloidal, granitoid.*
Ekloge	a choice selection (of colours or minerals?)	*eclogite.*
Elaion	oil	*æleolite.*
En	in	*enclave.*
Endon	within	*endogenetic, endometamorphism.*
Enstates	an adversary (to light)	*enstatite.*
Epi	upon	*epiclastic, epidiorite, epigenetic.*
Eu	well	*euhedral, euphotide, eutaxilic, eutectic.*
Eukritos	easily discerned	*eucrite.*
Euroeo	to flow well	*eurite.*
Euxenos	hospitable (rich in elements)	*euxenite.*
Ge	the earth	*geology.*
Genos	a race, a kind	*homogeneous.*

Genesis	origin	*diagenesis.*
Gennao	to beget	*authigenous.*
Glaucos	bluish-green	*glauconite, glaucophane.*
Grapho	I write	*graphite, graphophyre.*
Haima	blood	*hæmatite.*
Hals	salt	*halite, halogen.*
Haploos	simple	*haplite, aplite.*
Hemi	half	*hemicrystalline.*
Heteros	different	*heterogeneous, heteromorphic.*
Holos	complete	*holocrystalline.*
Homos	the same	*homogeneous.*
Hydor	water	*hydrothermal, hydatogenetic.*
Hyp, hypo	under, nearly, less than	*hypabyssal, hypidiomorphic, hypogene.*
Hyper	above	*hyperite, hypersthene.*
Hysteros	later	*hysterocrystallisation.*
Idios	one's own	*idiomorphic.*
Isos	the same	*isomorphous, isopachyte, isotherm.*
Kata	down from, down towards	*cataclastic, katagneiss, katamorphism.*
Kelyphos	a rind, shell	*kelyphitic.*
Keras	a horn	*keratophyre.*
Keros	wax	*ozokerite.*
Klastos	broken	*clastic, diaclase.*
Klino	I incline	*microcline, syncline.*
Koccos	a berry	*coccolite.*
Kolla	glue	*colloid.*
Kopros	dung	*coprolite.*
Krasis	a mixture	*polycrase.*
Krateo	I dominate	*melanocratic, leucocratic.*
Krokē	a thread	*crocidolite.*
Kryptos	hidden	*cryptocrystalline, cryptographic.*
Krystallos	ice	*crystal.*
Kyanos	blue	*kyanite.*
Laccos	a cistern	*laccolith.*
Lampros	bright	*lamprophyre.*
Lepis	a scale, flake	*lepidolite.*
Leukos	white	*leucocratic, leucophyre, leucoxene, leucite.*

Lithos	a rock	*lithology; -ite* (suffix in rock and mineral names); *-ith* (suffix in terms such as batholith, laccolith, denoting mode of occurrence).
Logos	a discourse	*petrology.*
Lopas	a basin	*lopolith.*
Lusis	a loosening	*pneumatolysis.*
Lyteos	fusible	*tachylyte.*
Macros	large, long	*macroscopic.*
Margarites	a pearl	*margarite.*
Megas	big	*megascopic.*
Meion	less	*meionite, miocene.*
Melos	black	*melanite, melanocratic, melaphyre.*
Meros	a part	*merocrystalline.*
Mesos	middle	*anamesite, mesocratic, mesolite, mesostasis.*
Meta	after (signifying a change)	*metamorphism.*
Micros	small	*microcrystalline, microscopic.*
Migma	a mixture	*migmatite.*
Monos	single	*monogenetic.*
Morphe	shape	*amorphous, allotriomorphic, metamorphic, idiomorphic.*
Mylon	a mill	*mylonite.*
Myrmeke	an ant	*myrmekite.*
Nema	a fibre	*nematoblastic.*
Nephele	a cloud	*nepheline.*
Oikos	a house	*oikocryst.*
Oligos	small, few	*oligoclase, oligocene.*
Oon	an egg	*oolite.*
Ophis	a serpent	*ophicalcite, ophite.*
Opsomai	to see	*diopside.*
Orthos	straight, rectangular, regular	*orthoclase, orthogneiss.*
Otelle	a scar	*chrysotile.*
Oxos	sour, acid	*oxide.*
Ozein	to smell	*ozokerite.*

Palaios	old	*palæo-picrite.*
Palin	again	*palingenesis, palimpsest.*
Pan	all	*pan-idiomorphic.*
Para	beside	*paragenesis, paragneiss, paramorphic.*
Pegma	a framework	*pegmatite.*
Pelos	clay	*pelitic.*
Peri	around	*pericline.*
Perknos	dark	*perknite.*
Petra	a rock	*petrology.*
Phacos	a lentil	*phacolith.*
Phaino	I show	*aphanitic, phenocryst, glaucophane.*
Phaneros	distinct	*phanerocrystalline.*
Phlogopos	fiery-looking	*phlogopite.*
Phone	sound	*phonolite.*
Phos	light	*euphotide.*
Phyllon	a leaf	*phyllite, apophyllite*
Phreatos	of a reservoir	*phreatic.*
Phyo	to produce	*apophysis.*
Physa	a stream, jet	*lithophyses.*
Picros	bitter	*picrite.*
Piezo	to press together	*piezocrystallisation.*
Pilos	a felt	*pilotaxitic, hyalopilitic.*
Pisos	a pea	*pisolite.*
Plagios	slanting, oblique	*plagioclase.*
Plasma	a moulded image	*glomeroplasmatic.*
Plektos	plaited	*symplektite.*
Plesios	neighbour	*plesiomorphous.*
Pleios	full, many	*pleochroism.*
Pluto	the God of the underworld	*plutonic.*
Pneuma	vapour	*pneumatolytic.*
Poikilos	spotted	*poikilitic.*
Polus	many	*polygenetic, polymorphism.*
Porphyreos	purple, reddish	*porphyry.*
Protos	first	*protoclastic, protogine*
Propylon	entrance	*propylite.*
Psammos	sand	*psammitic.*
Psephos	a pebble	*psephitic.*
Pseudes	false	*pseudo-tachylyte.*
Pyr, pyro	fire	*pyroclastic, pyromeride, pyroxene, pyrolusite.*
Rhegos	a blanket	*regolith.*
Rheo	to stream	*rhyolite.*

Sanis	a plank, table	*sanidine.*
Schistos	divided	*schist, aschistic, diaschistic.*
Ser	silk	*sericite.*
Sideros	iron	*siderite.*
Skia	a shadow	*skiadrome.*
Skopeo	to look at	*megascopic, microscopic.*
Soma	a body	*metasomatic.*
Sphallo	to slip	*asphalt.*
Sphe	a wedge	*sphene.*
Stasis	position	*mesostasis.*
Stalagma	that which drops	*stalagmite.*
Stalao	to fall in drops	*stalactite.*
Stauros	a cross	*staurolite.*
Stear	fat	*steatite.*
Sthenos	strength	*asthenosphere, disthene, hypersthene.*
Stilbo	to glisten	*stilbite.*
Stoa	a colonnade	*chiastolite.*
Stroma	a layer	*stromatolithic.*
Stylos	a pillar	*stylolite.*
Symplecktos	interlaced	*symplektite.*
Syn	together	*syngenetic.*
Synantesis	a meeting together	*synantetic.*
Tachys	quickness	*tachylyte.*
Taxis	arrangement	*ataxite, eutaxite.*
Tekton	a builder	*eutectic, tectonic.*
Tektos	melted	*tektite.*
Tephra	ashes	*tephrite.*
Thera	eagerly sought	*theralite.*
Thermos	hot	*thermal, thermodynamic.*
Trachys	rough	*trachyte.*
Trema	a hole	*diatreme, trematoblastic.*
Triches	hairs	*trichite.*
Troktes	a nibbler (e.g. trout)	*troctolite.*
Trope	a turn	*allotropy, isotropic.*
Tuphos	smoke, a cloud	*tuff.*
Xenos	a stranger	*leucoxene, pyroxene, xenomorphic.*
Zeo	I boil	*zeolites.*

APPENDIX D

LATIN WORDS AND PREFIXES

Ab	from, away	*ablation, abrasion, agglomerate.*
Acus	a needle	*acicular.*
Albus	white	*albïte.*
Alluo	to wash upon	*alluvial.*
Arena	sand	*arenaceous.*
Argilla	clay	*argillaceous.*
Com, con	together, with	*concretion, comagmatic, composite.*
Cornubia	Cornwall	*Cornubianite.*
Corona	a crown	*coronite.*
Cretus	grown	*calcrete, concrete, concretion.*
De	away from	*dedolomitisation, detritus.*
Denudo	to lay bare	*denudation.*
Duro	to harden	*indurate.*
E, ef, ex	out	*effusive, ejectamenta.*
Ferrum	iron	*ferruginous.*
Fibra	a thread	*fibrolite.*
Fio	to become	*silicified, vitrify.*
Flux	a flux	*fluorite.*
Fluvius	a river	*fluviatile.*
Folium	a leaf	*foliation.*
Fulgurus	lightning	*fulgurite.*
Fumus	smoke	*fumerole.*
Glomare	to gather in a heap	*agglomerate, conglomerate.*
Granum	a grain	*granite, granular.*
Ignis	fire	*igneous.*
Injicio	to throw in	*injected.*
Inter	between	*intercalate, intersertal.*
Intra	within	*intratelluric.*

Lacus	a lake	*lacustrine.*
Lapillus	a little stone	*lapilli.*
Later	a brick	*laterite.*
Lignum	wood	*lignite.*
Litus	coast	*littoral.*
Luere	to wash	*alluvial.*
Mico	to shine	*mica.*
Natus	born	*cognate.*
Novacula	a razor	*novaculite.*
Oliva	an olive	*olivine.*
Orbiculus	a small orb	*orbicular.*
Paulo	a little time	*paulopost.*
Pene	almost	*penecontemporaneous.*
Post	after	*paulopost.*
Pumex	froth	*pumice.*
Refrango	to break back	*refraction*
Rodo	to gnaw	*erode.*
Rudus	rubble	*rudaceous.*
Se	apart from	*secretion.*
Septum	a partition	*septaria*
Serpens	a serpent	*serpentine.*
Serto	I insert	*intersertal.*
Silex	flint	*silica, petrosilex*
Sub	under	*subhedral.*
Tactus	touching	*tactite.*
Tellus	earth	*intratelluric.*
Tero	to rub	*detritus.*
Trudo	to thrust	*intrusion*
Ultra	beyond	*ultrabasic, ultrametamorphism.*
Variola	smallpox, pitted	*variolite.*
Vermis	a worm	*vermicular.*
Viscus	bird lime	*viscosity*
Vitrum	glass	*vitreous.*

APPENDIX E

CLASSIFICATION TABLES

* In these Tables the names of *leucocratic* rocks are printed in *italic*, and those of **melanocratic rocks** in **heavy type.** See also A. Johannsen : *Journ. Geol.*, xxviii, 1920, p. 38, for a discussion of classification and nomenclature that has appeared since the pagination of this book.

CLASSIFICATION OF ROCKS AND ORE-DEPOSITS.*

I. ENDOGENETIC ROCKS and ORE-DEPOSITS.

Formed by processes of internal origin, which processes operate deep-seatedly or from within outwards. High temperature effects constitute the prevailing characteristic, and the water taking part as an agent is partly of magmatic origin.

1. *Igneous Rocks and Segregations.*

2. *Igneous Exudation Products.*

   (*a*) Contact impregnations and metasomatised rocks, including pneumatolytic rocks and deposits.

   (*b*) Hydrothermal vein rocks and deposits.

   (*c*) Solfataric deposits.

3. *Thermo-dynamically Altered Rocks and Deposits.*

* See T. Crook : *Min. Mag.*, xvii, 1914, pp. 73-4 and 84.

II. EXOGENETIC ROCKS and ORE-DEPOSITS.

Formed by processes of external origin, which processes operate superficially or from without inwards. These rocks are formed at ordinary or comparatively low temperatures, and the water taking part in their formation is of atmospheric origin.

1. *Weathering Residues.*

2. *Detrital Rocks (including Placer Deposits)*, comprising æolian, alluvial, and marine sediments, loose or cemented.

3. *Solution Deposits*, loose or cemented.
   (*a*) *Surface Solution Deposits.*
      (i) Inorganic deposits.
      (ii) Organic deposits.
   (*b*) *Percolating Solution Deposits.*
      (i) Certain vein deposits and cavity infillings.
      (ii) Metasomatic rocks and deposits, and secondary enrichments.

4. *Accumulations of Organic Matter and their Products.*
   (*a*) Carbonaceous.
   (*b*) Bituminous.

I. OVERSATURATED IGNEOUS ROCKS: CHARACTERISED BY QUARTZ.

Felspars.	$\frac{\text{Orthoclase}}{\text{Albite}} < \frac{30}{70} <$	$\frac{\text{Orthoclase}}{\text{Albite}}$	$< \frac{70}{30} < \frac{\text{Orthoclase}}{\text{Albite}}$
Albite.	*Pegmatite.* Soda-granite. Rockallite. Fasibitikite.	*Northfieldite.* Alkali-granite. Ekerite. Karite. (Nordmarkite.) (Evergreenite.)	*Alaskite.* (*Birkremite.*) *Aplogranite.* *Pegmatite.* *Arizonite.* *Graphic Granite.* *Tsingtauite.* *Muscovite-granite.* Potash-granite.
	Quartz-keratophyre. Beschtanite. Dahamite.	*Aplite. Quartz-lindoite. Quartz-bostonite. Aplite.* Granophyre. Grorudite. Paisanite. Granophyre. Ailsyte. Ekerite-porphyry.	*Alsbachite. Beresite.* Quartz-porphyry. Leopardite.
	Soda-rhyolite. Taurite.	Comendite. Quartz-pantellerite. *Tordrillite.* Volcanite. (Taimyrite.)	Potash-rhyolite.
Andesine—Oligoclase.	Quartz-diorite. Tonalite. Banatite.	*Aplodiorite.* Granodiorite. *Masanite. Windsorite.* Quartz-monzonite. Adamellite. Vaugnerite. Rapakivi. Unakite.	*Pegmatite. Graphic Granite.* Granite. Granitite. Charnockite. (Quartz-syenite.)
	Gladkaite. Quartz-porphyrite. Dacite-porphyry. **Volhynite.**	Markfieldite. Routivarite. (Ivernite.)	*Aplite.* Granite-porphyry. Quartz-porphyry. Granophyre. Microgranite. Elvan. Wennebergite.
	Quartz-andesite. Dacite. Rhyodacite. Ungaite. Shastaite. Esterellite.	Quartz-latite. Dellenite. Toscanite.	Rhyolite. Liparite. Lithoidite. Nevadite. Quartz-felsite. Pyromeride. Masanophyre.

Bytownite—Labradorite.	*Quartz-anorthosite.* Quartz-gabbro. Granogabbro. Quartz-hyperite. Quartz-norite. Quartz-dolerite. Granodolerite. Quartz-diabase. Vintlite. Quartz-basalt. Rhyobasalt. Bandaite.	Windsorite. Quartz-monzonite. Quartz-trachydolerite. Quartz-banakite. Toscanite.	
Anorthite.			
Felspars absent (or accessory).	**Quartz-pyroxenite.** **Quartz-hornblendite.** **Laanilite.**		

II. SATURATED IGNEOUS ROCKS.

Felspars.	Orthoclase / Albite $< \frac{30}{70} <$	Orthoclase / Albite	$< \frac{70}{30} <$ Orthoclase / Albite
Albite.	*Albitite.* *Holyokeite.* Soda-syenite. Krageroite.	*Hedrumite.* Laurvikite. Pulaskite. Umptekite. Lusitanite. Hatherlite. Leeuwfonteinite.	*Orthoclasite, Orthosite.* *Sanidinite.* Potash-syenite. Bowralite. **Durbachite.**
	Albitophyre. Keratophyre. Hirnantite. Varnsingite.	*Bostonite.* *Lindoite.* *Lestiwarite.* Atatschite. Rhomb-porphyry. Sölvsbergite.	Orthophyre. Orthofelsite.
	Pantellerite-trachyte. Beringite. Khagiarite.	Gibellite. Kenyte.	Sanidine-trachyte.
Andesine—Oligoclase.	*Oligoclasite.* *Andesinite.* Diorite, Laugenite. Ornoite. Orbite. Suldenite. Belugite. Amherstite. Plumasite. Yentnite.	Syenodiorite. Monzonite (in part). Akerite. Lakarpite. Mangerite. Tönsbergite. **Appinite.**	Syenite. Plauenite. Yogoite. **Shonkonite.** **Appinite.**
	Plagiaplite. Porphyrite. Microdiorite. Plagiophyre. Malchite. Cuselite. Luciite. Ortlerite. Aleutite. Toellite. Esterellite.	Lime-bostonite. Monzonite-porphyry. Mænaite. Gauteite.	Porphyry. Felsite. Felsophyre.
	Dioritic Lamprophyres. { **Spessartite.** **Kersantite.**		**Vogesite, Garganite / Minette.** { **Syenitic Lamprophyres.**
	Andesite. Auganite. Hawaiite. Ambonite. Boninite. Sanukite. Leidleite. Suldenite.	Trachyandesite. Latite. Domite. Banakite. Vulsinite. Dumalite.	Trachyte. Ponzite. Selagite.

Bytownite—Labradorite.	*Labradite. Labradorite Rock.* *Anorthosite.* Gabbro. Hyperite. Norite. Muscovadite. Issite. Bojite. Corsite. *Beerbachite.* Dolerite. Diabase. Ophite. Odinite. Algovite. Vintlite. Palatinite. Anamesite. **Camptonite. Topsailite.** *Santorinite. Labradorite.* Basalt. Tholeiite. Miharaite. Ininmorite. Alboranite. Nonesite Weiselbergite. Variolite. Sudburite. **Mimosite. Soggendalite. Arapahite.**	Monzonite. Syenogabbro. Orthoclase-gabbro. Monzonite-porphyry. Devonite. Gauteite. **Aschaffite.** Trachydolerite. Banakite.	
Anorthite.	*Anorthitite. Anorthite Rock.* Eucrite. Kedabekite. Kyschtymite. **Yamaskite.** Alboranite. Cumbraite.	Sebastianite.	
Felspars absent (or accessory).	**Pyroxenite. Pyroxenolite. Diallagite.** **Bronzitite. Hypersthenite. Websterite.** **Perknite. Davainite. Avezacite.** **Hornblendite. Amphibololite.** **Lherzite. Griquaite. Newlandite.** **Ariégite. Ostraite. Rodingite.** **Augitite. Erhwaldite.**		

III. UNDERSATURATED IGNEOUS ROCKS: CHARACTERISED BY OLIVINE.

Felspars	$\frac{\text{Orthoclase}}{\text{Albite}} < \frac{30}{70} <$	$\frac{\text{Orthoclase}}{\text{Albite}}$	$< \frac{70}{30} < \frac{\text{Orthoclase}}{\text{Albite}}$
Albite.		Olivine-alkali-syenite. Laurvikite. **Kvellite. Tjosite.** Rhomb-porphyry. Cascadite. Olivine-alkali-trachyte. Skomerite. Olivine-kenyte. Kaiwekite.	
Andesine—Oligoclase.	Olivine-diorite. Kauaiite. Marloesite.	Mugearite. Olivine-trachyandesite. Olivine-latite.	

Bytownite—Labradorite.	*Olivine-anorthosite.* Olivine-gabbro. Olivine-hyperite. Olivine-norite. Troctolite. Ossypite. **Tilaite.** **Kentallenite.**	Olivine-monzonite.	
	Olivine-dolerite. Olivine-diabase. Navite. Anamesite. **Camptonite.**		
	Olivine-basalt.	Olivine-trachydolerite. Ciminite. Absarokite Olivine-banakite.	
	Picrite-basalt. Ankaramite.	**Shoshonite.**	
Anorthite.	Allivalite. Ouenite. Rougemontite. **Harrisite. Tilaite. Olivine-yamaskite.**		
	Anorthite-basalt.		
Felspars absent (or accessory).	**Olivine-pyroxenite. Anabohitsite Bahaite. Picrite. Schriesheimite. Peridotite. Wehrlite. Koswite. Lherzolite. Harzburgite. Saxonite. Cortlandtite. Scyelite. Dunite. Valbellite. Griquaite. Eulysite. Nelsonite. Josefite. Cumberlandite**		
	Picrite-porphyry. Espichellite. Madeirite. Garewaite. Kimberlite.		
	Limburgite. Rizzonite. Verite.		

IV. UNDERSATURATED IGNEOUS ROCKS: CHARACTERISED BY FELSPATHOIDS.

Felsic Minerals	Orthoclase + Leucite / Albite + Soda-felspathoids $< \frac{30}{70} <$	Orthoclase + Leucite / Albite + Soda-felspathoids $< \frac{70}{30} <$	Orthoclase + Leucite / Albite + Soda-felspathoids
Albite.	Mariupolite. Naujaite.	Nepheline-syenite. Sodalite-syenite. Cancrinite-syenite. Eudialyte-syenite. Analcite-syenite. Laurdalite. Foyaite. Ditroite. Litchfieldite. Ledmorite Assyntite. Borolanite. Miaskite Agpaite. Lujavrite. Chibinite, Kakortokite. Covite. Canadite. **Malignite. Pienaarite. Marosite. Fergusite.**	Leucite-syenite. Pseudoleucite-syenite. Orendite. **Leucite-shonkinite.**
		Tinguaite. Ulrichite. Muniongite. Shackanite. Catapleiite-syenite. **Heumite.**	Leucite-tinguaite. Leucitophyre.
		Phonolite. Nosean-phonolite. Blairmorite. **Apachite.**	Leucite-phonolite. Leucite-trachyte.
Andesine—Oligoclase.	*Craigmontite. Raglanite.* Essexite. Dungannonite.	*Microtinite.* Laurdalite. Canadite. **Shonkinite.**	Marosite.
	Ordanchite.	Vicoite. Kulaite. Tahitite. Isenite.	

Bytownite—Labradorite.	Essexite. Theralite. Lugarite. Berondrite. Mareugite. Rouvillite.	Nepheline-monzonite. Heronite. Kassaite. Allochetite.	
	Analcite-dolerite, Teschenite. Crinanite.	Mondhaldeite.	
	(Camptonite).		
	Tephrite. Analcite-tephrite. Buchonite. Ordanchite. **Heptorite.**	Leuctite-tephrite. Campanite. Ottajanite. Viterbite. Tavolatite. Kulaite. **Braccianite.**	*Vesuvite*
Anorthite.		Puglianite.	
Felspars absent (or accessory).	*Congressite. Sodalitite. Sussexite.* Ijolite. Tawite. Monmouthite. Urtite. **Bekinkinite. Jacupirangite. Tamaraite.**	Arkite.	
	Nepheline-monchiquite. **Monchiquite. Fourchite.**	Katzenbuckelite. Leucite-monchiquite.	**Wyomingite.**
	Nephelinite. Haüynophyre. Noseanite. Analcitite. Mellilitite. Uncompaghrite. **Bermudite. Coppælite.**	Melilite-leucitite. Cecilite.	**Madupite.**

V. UNDERSATURATED IGNEOUS ROCKS: CHARACTERISED BY FELSPATHOIDS AND OLIVINE.

Felsic Minerals	$\frac{\text{Orthoclase + Leucite}}{\text{Albite + Soda-felspathoids}} < \frac{30}{70} <$	$\frac{\text{Orthoclase + Leucite}}{\text{Albite + Soda-felspathoids}} < \frac{70}{30} <$	$\frac{\text{Orthoclase + Leucite}}{\text{Albite + Soda-felspathoids}}$
Albite.		Sommaite (in part). Olivine-ulrichite.	**Leucite-cascadite.** **Jumillite.**
Andesine—Oligoclase.	Olivine-essexite.	**Olivine-shonkinite.** Pollenite	

Bytownite—Labradorite.	Olivine-essexite. Olivine-theralite. Luscladite. **Montrealite. Kylite.** Olivine-teschenite. Basanite. Macedonite. **Heptorite.**	Olivine-kulaite. Leucite-basanite.	
Anorthite.			
Felspars absent (or accessory).	**Olivine-bekinkinite. Fasinite. olivine-jacupirangite.** **Olivine-monchiquite. Alnöite. Farrisite. Giumarrite.** Nepheline-basalt. Melilite-basalt. Polzenite. **Analcite-basalt. Ghizite. Ankaratrite.**	Leucite-olivine-monchiquite. Onkilonite.	**Missourite.** Leucite-basalt. **Venanzite. Batukite.**

PRODUCTS DUE TO IGNEOUS EXUDATIONS.

Processes.	Characteristic Materials Introduced.	Parent Igneous Rocks.	Characteristic Alteration Types.
Tourmalinisation	Volatile compounds of boron with a certain proportion of fluorine compounds.	Granite and related minor intrusions.	Schorl Rock. Luxullianite. Trowlesworthite.
Axinitisation	Do, with iron compounds when associated with garnetisation.		
Greisenisation or **Greisening**	Fluorine compounds.		Greisen. Topazoseme.
Kaolinisation	Water and carbon dioxide.		Kaolin. China-clay rock.
Silicification	Silica, water, sulphides, and fluorine compounds.		Peach.
Garnetisation	Iron compounds, and sulphides.	Granodiorite.	Garnetised igneous rocks.
Scapolitisation or **Dipyrisation**	Volatile compounds of chlorine, titanium and phosphorus.	Gabbro, norite, and alk-syenite.	Scapolitised rocks. Kuskite, Yentnite. Hornblende-scapolite
Propylitisation	Water, carbon-dioxide, and sulphides.	Dacite, andesite, and related rocks (rarely rhyolite, and dolerite).	Propylite.
Sericitisation	Water, carbon-dioxide, and potash-compounds.		Quartz-sericite rock
Chloritisation	Water, sulphides, and iron compounds.		
Alunitisation	Water, sulphates, and potash.		Quartz-alunite rock
Silicification	Silica, water, sulphides, sulphates.		Silicified rocks.
Uralitisation	Water, carbon-dioxide, sulphides.	Gabbro. Dolerite.	Greenstone.
Chloritisation			
Saussuritisation			Diabase.
Epidotisation or **Zoisitisation**			Epidiorite. Epidosite.
Albitisation	Do, in solutions rich in sodium and iron.	Basalt. Dolerite.	Spilite. Albite-diabase.
Zeolitisation	Zeolites, silica and carbonates.	Basaltic rocks.	Amygdaloidal basalts. Melaphyres
Serpentinisation	Water, sometimes carbon-dioxide.	Picrite. Peridotite.	Serpentine Bowenite Chrysotile-asbestos.

PRODUCTS DUE TO IGNEOUS EXUDATIONS.

Country Rocks.	Characteristic Alteration Types.	Associated Ore-Deposits.	Processes.
Argillaceous and arenaceous sediments.	Tourmaline-hornfels and schist. Quartz-tourmaline rock. Tourmaline-corundum rock.	Cassiterite-wolfram lodes.	**Tourmalinisation**
Calcareous shales. Diabase.	Axinite-calc-flinta Limurite. Axinite-greenstone.	Tourmaline-copper lodes.	**Axinitisation**
			Greisenisation or **Greisening** **Kaolinisation**
		Sulphides generally, especially copper sulphides, and magnetite deposits.	**Silicification**
Diabase.	Garnetiferous greenstone.		**Garnetisation**
Calcareous rocks.	Various types of Garnetiferous skarn.		
Calcareous rocks.	Scapolite-marble and lime-silicate rocks.	Titaniferous magnetite, ilmenite, and apatite.	**Scapolitisation** or **Dipyrisation**
		Tertiary gold and silver lodes.	**Propylitisation**
	Sericite-schist.	Sericite-calcite gold deposits.	**Sericitisation**
Argillaceous rocks.	Chlorite-schist (?Banket, in part).	(?Rand gold deposits.)	**Chloritisation**
	Quartz-alunite rock.	Copper-gold deposits.	**Alunitisation**
Calcareous rocks.	Chert, phtanite. Quartz-barytes-rock.	Quicksilver deposits.	**Silicification**
Arg llaceous rocks.	Chlorite-schist.	Gold-telluride deposits.	**Uralitisation** **Chloritisation** **Saussuritisation**
	Chlorite-epidote schist. Spilosite. Adinole.		**Epidotisation** or **Zoisitisation** **Albitisation**
		Native copper deposits.	**Zeolitisation**
			Serpentinisation

CLASSIFICATION OF METAMORPHIC ROCKS.

	Cleaved.	*Brecciated.*	*Banded or Phacoidal.*	*Mylonitic.*	*Vitrified.*
Dominantly **Cataclastic**	Slate.	Crush-breccia. Crush-conglomerate. Kakirite.	Conglomerate-gneiss. Porphyroid. Augen-schist. Zobtenite. Flaser-gneiss.	Mylonite. Protomylonite. Ultramylonite. Flinty-crush Rock. Hartschiefer.	Buchite.

Unaltered Rocks.	**Maculose.**	**Schistose.**	**Gneissose.**	**Granulose.**	**Impregnated by Igneous Exudations.**
Arenaceous		Quartz-schist.	Psammite-gneiss.	Quartzite. Itacolumite.	Phthanite. Novaculite.
Argillaceous	Spotted 'slates.' Knotenschiefer. Chiastolite-'slate.' Ottretite-'schist.' Hornfels. Keralite. Proteolite. Astite. Aviolite. Edolite. Seebenite. Porcellanite.	Phyllite. Mica-schist. Andalusite-mica-schist. Sismondinite. Garnetiferous mica-schist. Staurotile.	Para-gneiss. Pelite-gneiss. Augen-gneiss (in part). Sillimanite-gneiss. Cordierite-gneiss. Garnetiferous gneiss. Cippolino.	Para-granulite, Leptite (in part). Kinzigite. Calc-silicate Rocks.	Killas. Cornubianite. Tourmaline-schist. Chlorite-schist. Spilosite. Adinole. Desmoisite. Calc-silicate Rocks.
Calcareous	Calc-flinta. Calc-silicate hornfels.	Calc-schist. Pinolite. Catawberite.	Ophicalcite.	Calciphyre-Sagvandrite. Crystalline Limestone. Dolomite-marble. Predazzite.	Limurite. Tactite. Skarn. Collobrierite.

Lateritic -				Emery Rock.	
Ferruginous -		Hæmatite-schist.		Taconite. Itabirite.	
Carbonaceous -		Graphite-schist.	Graphitic Gneiss.	Graphitic Granulite.	
Igneous Rocks (Mafic)	Certain types of Hornfels.	Talc-schist. Meta-basite. Chlorite-schist. Hornblende-schist. Actinolite-schist. Anthophyllite-schist. Glaucophane-epidote-schist. Murasakite.	Hornblende-gneiss. Amphibolite. Garnet-amphibolite. Epidote-biotite-gneiss. Garnet-biotite-gneiss.	Pyroxene-granulite. Eclogite.	
Igneous Rocks (Felsic)			Biotite-gneiss. Granite-gneiss. Ortho-gneiss. Augen-gneiss.	'Acid'-granulite. Leptite. Leptynite. Hälleflinta.	Cordierite-anthophyllite Rock.
Composite Rocks			Composite Gneiss. Injection-gneiss. Migmatite. Augen-gneiss. Hornblende-gneiss. Amphibolite.	Pyroxene-granulite (in part).	

CLASSIFICATION OF

DETRITAL SEDIMENTS.

Weathering Residues.	*Predominant Grades.*	*Compact Types.*	*Argillaceous.*	*Calcareous.*
Clay-with-Flints.	*Rudaceous or Psephitic.* Scree, Talus, Boulders, Shingle, Pebbles, Gravel	Breccia.	Boulder Clay. Tillite.	C. Breccia. Limestone Breccia. C. Conglomerate.
		Conglomerate.		Calcrete.
Residual Sands. Lateritic Sand. Quartzose Laterite.	Coarse Sand	Graywacké, Arkose, Grit.		C. Grit.
	Arenaceous or Psammitic. Sand. (Coral Sand.) (Volcanic Sand.)	Felspathic, Micaceous, Glauconiti and other Sandstones.	Loam. Argillaceous Sandstone.	C. Sandstone. (Dolomitic, Gypseous and Barytic Sandstone.)
Residual Clay. Terra Rossa. Lateritic Clay. Argillaceous Laterite.	Silt.	Siltstone.	Adobe. Loess.	Loess.
	Argillaceous or Pelitic. Clay. Rock-flour. Mud. Dust. (Coral Mud.) (Volcanic Mud.) (Red Clay.)	Shale. Mudstone. Clay Rock. Argillite. Pelite. Fireclay. Fuller's Earth.		C. Shale. Marl. (Red Mud.) (Green Mud.) (Blue Mud.)

SOLUTION DEPOSITS.

	Group.	*Saline, etc.*	*Calcareous, Dolomitic, etc.*
Laterite. Bauxite. Bole. Wacke. Kunkar.	**Inorganic.**	Rock Salt. Potash and other Saline Deposits. Trona. Nitrates. Caliche. Borates.	Calcareous Tufa. Travertine. Onyx-marble. Stalactite. Stalagmite. Oolite. Pisolite. Pea Grit. Magnesian Limestone. Dolomitic Limestone. Dolomite. Gypsum. Anhydrite.
	Organic.	(Potash and Iodine Salts from Kelp.)	Globigerina Ooze. Pteropod Ooze. Foraminiferal Limestone. Nummulitic Limestone. Chalk. Miliolite. Coral 'Sands.' Coral Limestone. Shell 'Sands.' Shelly Limestone. Crinoidal Limestone. Bryozoal Limestone. Algal Limestone. etc., etc., etc.
Lateritoid.	**Metasomatic.**		Dolomite.

DETRITAL SEDIMENTS.

Siliceous.	*Phosphatic.*	*Ferruginous.*	*Carbonaceous.*	*Bituminous.*
S. Breccia.		Canga. Laterite.		
S. Conglomerate. Preddingstone. Silcrete. Banket.	P. Conglomerate.	F. Conglomerate. Ferricrete. Carstone.		
S. Grit.		F. Grit.		B. Grit.
S. Sandstone. Quartzite. Itacolumite.		F. Sandstone. Itabirite.	C. Sandstone.	B. Sandstone.
Gannister.				
S. Shale. Bentonite. Catalinite.	P. Shale.	F. Shale. Pyritic Shale (Alum-Shale.)	C. Shale. Ampelite. Culm.	B. Shale. Blaes. Oil-shale.

SOLUTION DEPOSITS.

Accumulations of Organic Matter.

Siliceous.	*Phosphatic.*	*Ferruginous.*	*Carbonaceous.*	*Bituminous.*
Siliceous Sinter. Geyserite. Chert. Flint.		Lake and Bog Iron Ores, Blackband Ironstone.		
		(*Manganese*) Pelagite.		
Diatom Ooze. Diatomaceous Earth. Tripoli. Kieselguhr. Randannite. Radiolarian Ooze. Radiolarian Chert.	Bone Beds. Coprolites. Guano. Phosphorite.		Peat. Lignite. Brown Coal. Bituminous Coal. Cannel Coal. Anthracite.	Bitumen. Asphaltite. Manjak. Albertite. Gilsonite. Uintaite. Torbanite. Jet. Elaterite. Ozokerite. etc.
Chert. Flint. Novaculite. Lydite.	Phosphate Rock. Phosphatic nodules. Phosphorite.	Ironstone. Minette.		

CLASSIFICATION OF METEORITES. (By Dr. G. T. Prior, F.R.S.)

	Group. ——>	1	2	3	4
Class. ↓	Nickel-iron :	Fe : Ni = 13 or over.	Fe : Ni = 13 to 8	Fe : Ni = 8 to 2.	Fe : Ni = 2 or less.
	Magnesium silicate minerals :	*Enstatite.* Almost free from FeO. Almost free from CaO. MgO : FeO very high to ∞.	*Bronzite* and *Olivine.* Poor in FeO. Poor in CaO. MgO : FeO = 4 or over.	*Hypersthene* and *Olivine.* Richer in FeO. Poor in CaO. MgO : FeO = 4 to 2.	*Pyroxene* and *Olivine.* Still richer in FeO. Less poor in CaO. MgO : FeO = 2 or less.
	Felspars :	*Oligoclase.*	*Oligoclase.*	*Oligoclase.*	*Anorthite.*
Irons.	**Siderites.** Mainly nickel-iron. *Symbol*, S.	Nickel-poor Ataxites Hexahedrites. Coarsest to coarse Octahedrites. S1.	Medium to finest Octahedrites. S2.	Nickel-rich Ataxites. S3.	(Oktibbeha County.) S4.
Stony-Irons.	**Lithosiderites and Siderolites.** Nickel-iron in large amount. *Symbol*, L.	— L1.	Most Pallasites. Siderophyre. Mesosiderites.* Lodranite. L2.	A few Pallasites. L3.	— L4.
Stones (Acrolites).	**Chondrites.** Nickel-iron in decreasing amount from left to right. *Symbol*, C.	*Enstatite-chondrites.* Daniel's Kuil (Hvittis) Type. C1.	*Bronzite-olivine-chondrites.* Kroonstad Type. C2.	*Hypersthene-olivine-chondrites.* Baroti (Soko-Banja) Type. C3.	— C4.
	Achondrites. (Non-chondritic stones) Nickel-iron in small amount or absent. *Symbol*, A.	Aubrites (Aubres, Bishopville and Bustee). A1.	Ureilites. A2.	Diogenites (Shalka). Chassignites. Amphoterites (and Rodites). A3.	Angrite. Nakhlite. Howardite. Eucrite. Sherghottite. Mesosiderites.* A4.

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By

ARTHUR HOLMES, D.Sc., A.R.C.S., F.G.S.

Demonstrator of Geology, and Petrology, Imperial College of Science and Technology.

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